

CHALLENGES IN CARBON MARKETS - LESSONS FOR EMERGING EMISSION TRADING SYSTEM (ETS) AND OFFSET MARKETS (CASE STUDY: INDONESIA)

A Thesis

**Submitted to the Master of Finance in Sustainable Finance Study
Program at the Faculty of Economics and Business in partial
fulfillment of the requirements for the degree of**

Master of Finance in Sustainable Finance (M.Fin.)



by:

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UNIVERSITAS ISLAM INTERNASIONAL INDONESIA

DEPOK

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ABSTRACT

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Carbon markets are increasingly recognized as vital instruments for reducing greenhouse gas (GHG) emissions and addressing climate change. As developing countries adopt market-based climate policies, understanding the operational challenges and potential of these markets becomes essential. This thesis examines the key regulatory, structural, and integrity-related issues facing Indonesia's carbon market, with a focus on its Emissions Trading System (ETS) and offset programs. Using a mixed-methods approach combining document analysis of global case studies and in-depth stakeholder interviews, the research explores the institutional, technical, legal, and financial dimensions shaping Indonesia's carbon market development. Sources include EU ETS literature, ASEAN regional reports, World Bank publications, and national regulatory presentations. The findings indicate persistent challenges such as fragmented governance, low liquidity, inadequate MRV and registry systems, and unclear legal frameworks. Stakeholders further identified untapped opportunities in nature-based solutions, digital innovation, and cross-border cooperation. Drawing lessons from the EU and ASEAN, the study emphasizes the need for phased policy rollout, stronger institutional alignment, price transparency, and fraud safeguards. Ten policy recommendations are proposed, including capacity-building, legal reforms, and alignment with Article 6 of the Paris Agreement. The novelty of this research lies in its triangulated methodology and its actionable synthesis of international best practices tailored to Indonesia's context. This work contributes to the emerging literature on carbon markets by offering both diagnostic insights and policy-oriented solutions for market credibility and scalability.

Keywords: *Carbon market, Emissions Trading Scheme, Offset market, Indonesia, Market Integrity, Policy reform.*

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This thesis is **dedicated to the memory of my late father**, who sadly passed away in **October 2024**, at the very beginning of this research. His values, strength, and belief in education continue to inspire me every day. May his soul rest in peace.

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TABLE OF CONTENTS

STATEMENT OF AUTHENTICITY	i
ANTI-PLAGIARISM STATEMENT.....	ii
THESIS ATTESTATION	iii
THESIS DEFENSE APPROVAL	iv
ABSTRACT	v
ACKNOWLEDGMENT	vi
ABBREVIATION DIRECTORY.....	xi
CHAPTER I.....	1
INTRODUCTION	1
1.1 Background.....	1
1.2 Problem Statement	4
1.3 Research Question.....	8
1.4 Objectives	9
1.5 Scope and Limitations	9
CHAPTER II	1
LITERATURE REVIEW	1
2.1 Theoretical Framework.....	1
2.2 Theory of Climate Change.....	1
2.3 Mechanisms to Reduce Emissions	2
2.4 International Legally Binding	5
2.5 Lessons from Previous Research on Carbon Markets	5
2.6 The Net-Zero Roadmap to Achieving Global Target	11
2.7 Regulation to Support Carbon Exchange:.....	11
2.8 Risks in Carbon Market (Fraud and Beyond)	13
2.9 Overview of the Carbon Market.....	15
2.10 ETS and Offset Systems	17
2.11 Systems Design and Role in Emission Reduction.....	22
2.12 The Role and Limits of Regulatory Frameworks in Carbon Market Development ...	24
2.13 Technological Interventions.....	26
2.14 Gaps in Knowledge	27
CHAPTER III	29
METHODOLOGY.....	29
3.1 Research Design.....	29

3.1.1 Scoping and Data Collection.....	31
3.1.2 Data Collection Methods.....	32
3.1.3 Coding of the Data.....	33
3.1.4 Document Analysis.....	34
3.1.5 Semi-Structured Interviews	35
CHAPTER IV	37
FINDINGS AND ANALYSIS (DOCUMENT ANALYSIS APPROACH).....	37
4.1 Overview of the Carbon Market in Indonesia	37
4.1.1 Primary vs. Secondary Markets.....	37
4.1.2 Voluntary vs. Mandatory Carbon Markets.....	38
4.1.3 Key Thematic Findings.....	38
4.2.1 Key Findings from Document Analysis.....	41
4.3 Analysis of Interviews for Triangulation and Synthesis with Document Analysis	45
4.4 Lessons Learned for Emerging ETS and Offset Markets	49
CHAPTER V	51
CONCLUSION.....	51
5.1 Conclusion	51
5.2 Contributions to Knowledge	52
5.3 Policy Recommendation.....	53
5.4 Limitations and Areas for Future Research	54
REFERENCES	55
APPENDIX	65

LIST OF TABLES

Table 2.1 Lessons Learned from the Design and Implementation of Carbon Markets	8
Table 3.2 List of documents used in the analysis and findings.....	35
Table 3.3 List of Interview Participants	36
Table 4.4 List of Themes and Sub-Themes.....	46

LIST OF FIGURES

Figure 2.1 Global GHG emissions covered by ETSs and carbon taxes	4
Figure 2.2 Overarching compliance and monitoring structure	13
Figure 2.3 Establishment of ETSs worldwide over time.....	16
Figure 2.4 Offset programs around the world.....	18
Figure 2.5 Sources for offsets for an ETS	20
Figure 2.6 Types of carbon crediting mechanisms and market segments	21
Figure 2.7 ETS design in 10 steps.....	23

ABBREVIATION DIRECTORY

ASEAN	: <i>Association of Southeast Asian Nations</i>
CCS	: <i>Carbon Capture and Storage</i>
CDM	: <i>Clean Development Mechanism</i>
CO ₂ e	: <i>Carbon Dioxide Equivalent</i>
CSR	: <i>Corporate Social Responsibility</i>
ETS	: <i>Emissions Trading System</i>
ESG	: <i>Environmental, Social, and Governance</i>
EU	: <i>European Union</i>
EU ETS	: <i>European Union Emissions Trading System</i>
GHG	: <i>Greenhouse Gas</i>
IETA	: <i>International Emission Trading Association</i>
IDX	: <i>Indonesia Stock Exchange</i>
IDXCarbon	: <i>Indonesia Carbon Exchange (under IDX)</i>
IOJI	: <i>Indonesian Ocean Justice Initiative</i>
IPCC	: <i>Intergovernmental Panel on Climate Change</i>
MRV	: <i>Monitoring, Reporting, and Verification</i>
MOEF	: <i>Ministry of Environment and Forestry (Indonesia)</i>
MRA	: <i>Mutual Recognition Agreement</i>
NDC	: <i>National Determined Contribution</i>
OJK	: <i>Otoritas Jasa Keuangan (Financial Services Authority of Indonesia)</i>
PLN	: <i>Perusahaan Listrik Negara (State Electricity Company of Indonesia)</i>
REDD+	: <i>Reducing Emissions from Deforestation and Forest Degradation</i>
SRN-PPI	: <i>Sistem Registri Nasional Pengendalian Perubahan Iklim (National Registry System for Climate Change Control)</i>
UNFCCC	: <i>United Nations Framework Convention on Climate Change</i>
UNODC	: <i>United Nations Office on Drugs and Crime</i>
VAT	: <i>Value-Added Tax</i>

CHAPTER I

INTRODUCTION

This is the first chapter of the thesis on the topic “Challenges in Carbon Markets and Lessons for Emerging ETS and Offset Markets (Case Study: Indonesia)”. This section entails the details of what inspired this study and what it aims to address. It consists of the background of the research, the problem statement, the relevance of the study, the research objectives, the questions, the scope and limitations of the research, and the main argument of the author.

1.1 Background

For over a century now, it has been reported that global warming is rising exponentially, thus posing a significant threat to our very existence. The increase in the rate has been due to human activities that continuously result in releasing more carbon dioxide (CO₂) and greenhouse gases into the atmosphere (Ludeña et al., 2016). Although this is a global issue and the negative impacts of climate change challenges are felt globally; however, due to the excessive limitations of governance, infrastructure, and resources, developing countries are more vulnerable to climate change impacts (Mendelsohn, 2012).

The challenges of climate change to global welfare and the urgent need for mitigation measures cannot be overemphasized, especially for developing countries. Hence, global legally binding agreements such as the Kyoto and Paris Agreements were established in response to global climate change (World Bank, 2018). These international agreements introduce market-based mechanisms such as the Clean Development Mechanism (CDM), Joint Implementation (JI), and International Emission Trading (IET) geared toward reducing greenhouse gas emissions (Schneider, 2019). These also help guide developing countries and facilitate the development of their Nationally Determined Contributions (NDCs) (World Bank, 2018). Helping developing countries respond to the requirements to regulate laws and policies to attain a low-carbon economy and fortify them both nationally and beyond (Ventura et al., 2015).

As part of the global response to climate change challenges, carbon trading has been highlighted as a key component (De Godoy & Saes, 2016). And EU Emission Trading System (EU ETS) has been rapidly growing to accommodate more sectors and countries (De Godoy & Saes, 2016). The Paris Agreement Articles 6.2, 6.4, and 6.8 play a significant role in ensuring dependable carbon markets, which can contribute immensely toward global emission reduction (Minas, 2022). Because they provide frameworks that facilitate cross-border carbon

trading and encourage international cooperation to further develop the carbon trading mechanisms (Newell et al., 2014). The objective of Article 6 of the Paris Agreement is to maximize global emission reduction and promote sustainable development at the same time (Newell et al., 2014). The Kyoto Protocol aims to use trading mechanisms to control carbon emissions (Cheng, 2022).

Various mechanisms have been identified and used for delivering emission reduction, (Wang & Yi, 2023) highlighted that industrial agglomeration, technological progress, foreign direct investment, and environmental regulation are instrumental for reducing emission intensity and encouraging green industries. (Lakshmi et al., 2012) identifies carbon trading as an emission reduction mechanism that employs a cap and trade system. A mechanism that keeps emissions within approved limits. In addition, carbon trading enables the incentivizing of carbon emissions through the buying and selling of credits and allowances (Schneider, 2019), thus effectively creating a market to reduce carbon emissions. And the trading systems consist of various types, including the ambient permit system, emission permit system, and pollution offset systems (De Godoy & Saes, 2016).

Carbon markets normally work under two basic mechanisms namely the emissions trading systems (ETS) and carbon offset programs. However, both are the policy tools aimed at putting a price on carbon emissions with the aim of encouraging lowered emissions (Aptasari, 2024). ETS model is based on a cap and trade system in which governments or regional blocks establish a limit on the total amount of greenhouse gases (GHG) that can be emitted and the emission allowances are distributed to the emissions regulated entities. Firms emitting below their respective quotas may also transfer their unused allowances to the firms utilizing more than their targets thereby making a market in emissions permit (Syahrudin et al., 2024). In this regard, nations or territories with spare emission allowance can sell their allowances to others that need more space to achieve their climate goals (Ludeña et al., 2016).

Equally, the carbon offsets enable an individual or an institution to neutralize what they emit by purchasing a project that will eliminate or reduce atmospheric carbon. Such efforts are renewable energy generation, the development of energy efficiency, afforestation or reforestation (Syahrudin et al., 2024). Both mechanisms are expected to achieve a decrease in net emissions, but ETS is defined as a regulated model of compliance in existing industries with limited capped potential, whereas the offsets represent a much more flexible, project-interest approach to achieving climate objectives.

Part of the reason why the carbon market and trading are effective mitigation tools is because of their significant social and economic impacts. Moreover, it attracts and encourages

cross-border corporations, which is critical to reducing emissions globally, and the cost of emission trading can also drop with the participation of some developing countries like China and India (Ludeña et al., 2016). Although the potential for the carbon market to offer avenues for economic growth and significantly reduce emissions, there are also challenges that undermine its effectiveness, such as high potential for fraud, implementation, scope issues, the monitoring aspect, baselines, and leakage (Myers, 2007).

In response to climate change threats and challenges, developing countries like Indonesia have adopted some emerging climate change mitigation tools and systems like the carbon market and trading to reduce deforestation and other related issues (Rachmaniar et al., 2021). With these, they can allocate entity permissions for emission, therefore, enabling them to trade excess allowances (Ummul Firdaus & Nanda Sava Arkananta, 2024). Such climate change mitigation has great potential for developing countries like Indonesia, considering the fact that the country's tropical forest can absorb about 25.18 billion tons of carbon emissions, making the country a potential trading partner for developed countries (Aptasari, 2024). However, these impacts are not always the same for all developing countries, depending on their activities in areas like the energy industry, the magnitude of their emission, as well as energy exports, and trading counterparts (Ludeña et al., 2016).

Additionally, developing countries benefit from the investments from countries like Australia, New Zealand, and Canada towards emission reduction projects. This, in turn, helps them generate credits from such projects towards their commitments to the Kyoto Protocol (Ludeña et al., 2016). This evidence indicates the significance of carbon markets in mitigating climate change issues. The primary aim of carbon markets such as the European Union Emission Trading System (EU ETS) is to remedy the negative impacts that come from the use of fossil fuel by internalizing it and supporting funding towards low-carbon innovation and affected communities from climate change (Bryant, 2019). Achieving this aim, however, is challenging due to the massive influence of the fossil fuel industry over the EU ETS; thus, ultimately compromising the potential to benefit as intended.

These mitigation tools are not only crucial for reducing emissions. They are also instrumental in creating incentives for the involved participants; Hence, one of the key components of the carbon market is the EU ETS (Kristianto, 2024). The EU ETS mode of operation is through the cap-and-trade system, which is one of the two methods of ETS in the carbon market. Their jurisdiction stretches across 31 countries, and around 45% of the EU's GHG emissions are covered within that (Kristianto, 2024). ETS and carbon offset programs are innovative and relatively inexpensive means to provide markets for credits that are

produced through activities such as afforestation and conservation in the forestry sector to reduce GHG emissions (Syahrudin et al., 2024).

Although ETS and offset are effective climate change mitigation instruments, however, their supervision and verification need to be strict to prevent fraud and other regulatory risks (Syahrudin et al., 2024). The vulnerability of the carbon market to risks due to its complexity concerning the measurement and verification in reducing emissions contributes to the challenges that undermine the efforts of mitigating climate change issues (Wicaksono, 2024). The effectiveness of carbon markets to combat global climate issues through emission reduction cannot be overemphasized.

Countries like Indonesia have immensely benefited from the implementation of various policies to regulate carbon trading, emission trading systems, and results-based payments. These have set the stage for them to establish their domestic carbon market, thus ultimately aiding in their efforts to achieve a low-carbon economy (S. & B., 2023). But to fully benefit from the carbon market, addressing technical constraints and stakeholder engagement is crucial (Ummul Firdaus & Nanda Sava Arkananta, 2024), and requires urgency to implement in order to help Indonesia fulfill its commitments for international emission reduction (Nasir, 2024). The study of the carbon market within the global south is of significant importance as the carbon market could aggravate irregular development because these mechanisms are being utilized by emerging economies for expansion (Böhm et al., 2012).

1.2 Problem Statement

Carbon markets are essential for tackling global warming, but there are several problems in emerging markets that may influence their performance. Issues such as many different regulations, inefficient markets, low transparency, and fraud concerns affect the sector (Kristianto, 2024). A lack of coordination and conflicting roles among organizations make it challenging to set up carbon pricing. Insufficient liquidity, absence of well-formed prices, and low awareness among the public make the market less attractive to participate in. Even now, there is not much fraud in Indonesia, but other challenges do exist, and if left unchecked, there is still a possibility of problems like manipulation, price volatility, non-additionality, and incorrect crediting happening in Indonesia's emerging carbon market. Overcoming these various obstacles will play a key role in bringing together a strong carbon market that encourages investment and respects environmental rules.

Meanwhile, the global climate goals are significantly threatened by the weaknesses of carbon markets to risks of fraud, and challenges. As instrumental as it can be in addressing

global climate issues, the threat to the carbon market's credibility due to fraudulent activities is immensely high (Wicaksono, 2024). Carbon pricing mechanisms are key components for establishing and maintaining carbon trading. However, when trust becomes an issue it compels stakeholders to lose faith and as a result (Kerr, 2022), therefore, impacting the usefulness of this mechanism.

With fraudulent activities, individuals and institutions use carbon markets as instruments to falsify their performance on the environment rather than disclosing their actual greenhouse gas emissions (Schneider, 2019). Specific cases under the Kyoto Protocol's mechanisms highlighted projects that aim at lessening HFC-23 and SF₆ waste gas emissions, instead of using carbon credits to make a profit and generate more waste gas (Schneider, 2019). Therefore, global efforts to address climate change have created more problems than solutions (Wicaksono, 2024). In the ETS and carbon offset markets, their complex procedures to monitor and verify carbon credits sometimes make them vulnerable to fraud (De Godoy & Saes, 2016). It makes it easy to conduct illegal activities and harder to detect fraud (Aptasari, 2024). This is why carbon fraud is one of the main factors causing setbacks in carbon markets (Cheng, 2022).

Fraud in carbon markets can happen when false claims are made about reducing emissions while they do not occur, or when a sale of carbon credits that do not match the emission reductions occurs (Bryant, 2019). Some of the examples of the frauds that are usually present in carbon markets involve fictional projects, double counting, leakage, additionality, embezzlement, identity theft, and fatwah, carbon laundering, and non-compliance (Aptasari, 2024; Wicaksono, 2024). Such activities as non-compliance or the criminal actions of the firms may have a detrimental effect to the carbon trading schemes. The (World Bank, 2018) mentions the false reporting of environmental benefits of the projects as one of the major risks that diminish the confidence of the stakeholders in the carbon markets. These type of frauds is a problem to these markets and may undermine the capacity of the regulatory mechanisms as well as the general endeavours towards transparency and accountability (Aptasari, 2024). Such problems are especially problematic in emissions trading schemes (ETS) and carbon offsets markets, as they might impede the capacity of nations and businesses to reach their emission reduction objectives and therefore decelerate the overall pace of transition of economies to a low-carbon economy (Bryant, 2019).

Presence of leakages within the system of regulation and verification could even cause harm to the surrounding environment, making it vulnerable to manipulation and abuse (Aditwarman, 2024). This is not only a threat to the viability of carbon trading schemes, but it

also means a huge setback as to whether international climate goals will be achieved or not (Schneider, 2019). Such cases as false reporting of projects or issuing of false non-credible credits negate the ecological integrity of the carbon markets as well as the credibility of the carbon markets (Aditwarman, 2024).

Such challenges can also deter investments since uncertainty and a sense of risk push investors away from funding climate projects (De Godoy & Saes, 2016). Also, the balance of supply and demand of carbon credits is disrupted because of inconsistencies in regulation, as there are risks of both fraud and lax supervision. This will have an increased impact on the destabilization of the market and, in the end, will undermine trust and participation of the public within the carbon pricing projects, thus lessening the general support of climate mitigation policies in its entirety (Syahrudin et al., 2024).

As carbon markets globally increase, the issue of the circulation of counterfeit/low-quality carbon credits has grown in concern. According to the warning of (Interpol, 2013), these fake credits can be bought and sold across international boundaries, making a possibility of more emission of greenhouse gases (GHG) and not a decrease. In the absence of reliable system environments, such practices may go a long way in bringing into question the credibility and environmental performance of national and international carbon markets (Syahrudin et al., 2024). Challenges such as fraud on carbon market have a rather severe effect, and the implications of the studies on carbon markets and their input into global climate objectives are highlighted (Aptasari, 2024). How far the repercussions of fraud may well go extends further than slowing down migration towards achieving the climate goal; it can pose a risk of massive magnitude to the investors and also other parties involved reputationally, legally, and even expenditure wise (Ludeña et al., 2016).

International organizations like Interpol have valued the carbon market to be around \$176 billion worth, and have raised concerns for more observance of the criminal activities that pose a threat to it (Aditwarman, 2024). Due to the complexity of ETS and offset markets, fraudulent activities like false claims and fake carbon credits usually happen (Interpol, 2013). Hence, INTERPOL identifies crimes related to carbon trading as emerging environmental financial crimes (Interpol, 2013). In addition, FATF has also identified several environmental crimes such as illegal logging, illegal wildlife trade, and waste trafficking (FATF, 2020). Stressing their potential impact on the environment, economy, health, and safety of the public. Nevertheless, to effectively address the issues of environmental crimes, including financial and fraud in carbon markets, stakeholder collaboration and coordination at regional and global levels are essential (FATF, 2020; Interpol, 2013).

Several concerned environmentalists have highlighted the urgent need for everyone's involvement to reverse the impacts on the planet. It is in this spirit that emerging climate mitigation initiatives, such as the carbon markets, are introduced, so they could help in reducing GHG emissions. However, there have been various challenges that are undermining their effectiveness, and fraud is one of these challenges. Because of fraud in carbon markets, many projects fail to deliver the expected result. Many institutions and individuals have also incentivized the carbon markets to gain profit while negatively impacting the environment.

Investors and stakeholders continue to lose trust in the effectiveness of carbon markets in reducing emissions. And this trend will keep increasing should we fail to change the way we exploit the carbon market. The study emphasizes understanding the various problems that make it hard for carbon markets to prosper in developing countries. It is important for Indonesia to address possible weaknesses in its carbon pricing regulations, operations, and prevention of fraud. This study highlights the issues that affect the market so that market stakeholders and policymakers can work towards improving it. The research plays a role in world discussions about climate finance, regulations on carbon, and ensuring reliable climate solutions.

Policy weaknesses are also contributing factors that undermine the effectiveness of carbon markets, especially the linking of markets (Cullenward, 2015). (Sovacool, 2011) highlighted policy-related issues as the core of the four categories of problems with the global carbon market. (Willner & Perino, 2022) also underscored the EU's policy weakness challenges on climate policy and its ETS. California's cap-and-trade system, for example, the policy allowed the transfer of liability from regulated entities to unregulated parties (Cullenward, 2015). Causing environmental integrity and market compliance issues.

In addition, due to issues in Indonesia's carbon trading framework under Presidential Regulation No. 98 of 2021, the market is experiencing regulatory overlaps, inadequate monitoring and reporting, and insufficient institutional capacity for enforcement (Rahmawati et al., 2024). Furthermore, (Sofiyati & Hernawan, 2023) underscored that both policy effectiveness and public trust in Indonesia are significantly impacted due to the existing gaps in sustainable reporting and poor legal enforcement.

Therefore, it is of great significance to provide vigorous systems and verification mechanisms that can help to prevent fraud and address various challenges to build and maintain confidence (Aditwarman, 2024), aid in the environmental policy design processes, and encourage investments in carbon market projects to effectively use it for reducing GHG emissions (Syahrudin et al., 2024). Hence, Article 6 of the Paris Agreement and the Kyoto

Protocol are part of the mechanisms that also aim at mitigating fraud through their mandatory guidelines for offset projects, and the encouragement of independent audit and transparency (Ludeña et al., 2016).

As developing countries increasingly adopt emerging carbon markets like ETS and offset systems, it is important that they consider various risks that are often found in carbon trading systems. And devise solutions to mitigate the consequences of these risks in order for them to have reliable and transparent carbon trading systems. Some of these risks include environmental and social risks, reputational risks, regulatory and legal risks, monitoring and verification risks, etc. When risks in carbon markets are not addressed, they increase the vulnerability of the system, therefore enabling inefficiency in the system, which ultimately undermines the effectiveness and contribution of the system to global emission reductions.

Some of the emerging countries, like Indonesia, are hopeful that the effect of the carbon market can catalyze their efforts to achieve a net-zero commitment. This is practically achievable considering the fact that the country's tropical forest can absorb about 25.18 billion tons of carbon emissions (Aptasari, 2024). Making it one of the most suitable countries that can rely on nature-based products and solutions. Notwithstanding, the impact of challenges in carbon markets has the potential to deprive them of attaining their net-zero targets. However, if they can address certain challenges in the carbon markets they are designing, the country would stand a chance to reap the full benefits of carbon markets; thus, ultimately enabling them to significantly contribute to global emission reduction and, therefore, achieve its net zero commitment.

1.3 Research Question

This study aims to identify the challenges in carbon markets, specifically in emission trading systems (ETS) and offsets. This is the section where the author formulated a research question that will enable and aid in finding relevant insights around the subject matter through the designed research method. The findings from these research questions are hoped to help in providing information that could be in turn used for drawing out solutions and recommendations to address challenges in carbon markets and serve as a guide for further academic research. The formulated questions are as follows:

Main Research Question:

What are the key challenges facing Indonesia's carbon market, and what lessons can be learned for emerging ETS and offset markets?

Specific Research Questions:

- a. How effective is Indonesia's regulatory and institutional framework in supporting the development of a credible and internationally aligned carbon market?
- b. What are the structural and operational inefficiencies affecting the performance of Indonesia's carbon market, and how do they impact market participation and pricing?
- c. What are the key risks related to fraud and lack of transparency in Indonesia's carbon market, and how effective are current MRV systems in addressing them?
- d. What lessons can be drawn from Indonesia's experience to inform the design and implementation of carbon markets in other emerging economies?

1.4 Objectives

To examine the key challenges facing Indonesia's carbon market, focusing on regulatory issues, market inefficiencies, and fraud risks, and to derive lessons for emerging Emissions Trading Systems (ETS) and offset markets.

Through this, this research will critically examine the practicality of the regulatory framework in Indonesia in its carbon markets, noting the gaps, lack of consistency, and to what extent the national policies are consistent with the international climate commitments like the Paris Agreement. The study will also seek to provide a holistic assessment of the structural nature of carbon market in Indonesia, especially regarding price uncertainties, low trade volume, and restrictions to trade by different stakeholders. In this, it takes into account the roles and efforts of the governmental institutions, the representatives of the private sector, and the global organizations in expanding a more effective and open market. The research also examines the possibility of fraud and manipulation in the existing trading system and looks at the effectiveness of the current monitoring, reporting, and verification (MRV) systems that are in place to address these potential risks. Beyond these core issues, the research seeks to draw valuable insights and lessons from Indonesia's evolving carbon market lessons that could inform the development of similar systems in other emerging economies. The ultimate objective is to propose well-grounded policy recommendations that align with international best practices and support the credibility and growth of Indonesia's carbon trading framework.

1.5 Scope and Limitations

To guide this study, the author identified the scope and limitations of this research to focus on selected case studies. This study evaluates the challenges faced in Indonesia's emerging carbon trading environment. It depends on information from interviews with

stakeholders and analysis of documents. The analysis mostly focuses on Indonesia but also looks at international perspectives. No measurements of emissions-reduction levels or carbon price models are made in the research. At the same time, preventing fraud is taken into account, being one of the main challenges for the market.

CHAPTER II

LITERATURE REVIEW

This section of the thesis presents the collection of literature that was studied and applied to inform this research. The relevance and contribution of this research were established with the help of various literature and cases that are discussed in this section.

2.1 Theoretical Framework

This study is grounded in two complementary theoretical lenses: Institutional Economics and Stakeholder Theory. These frameworks provide insight into the structural, behavioral, and governance dimensions of carbon market development in emerging economies such as Indonesia.

Institutional economics focuses on how institutions, defined as the rules, norms, and organizations that structure economic behavior, influence market outcomes. In carbon markets, these institutions include regulatory bodies, market infrastructure example, MRV and registries, and pricing mechanisms. (North, 2013) argues that effective markets rely on stable institutions that reduce uncertainty and transaction costs. In the Indonesian context, the absence of a clearly defined carbon tax, fragmented agency mandates, and evolving MRV standards create institutional frictions that hinder efficient market operations.

Stakeholder theory suggests that organizations operate within a network of interdependent relationships involving various stakeholders, i.e., governments, private firms, NGOs, and civil society, and each with distinct interests (Freeman & McVea, 2002). In a carbon market, these stakeholders shape market design, influence rule-making, and affect implementation through their incentives and power dynamics.

Stakeholder interviews revealed divergent priorities between government regulators focused on compliance and sovereignty, private sector actors seeking profitability and global recognition, and international entities advocating for integrity and transparency. Using stakeholder theory allows the thesis to analyze how these interactions either support or impede the formation of a robust carbon trading system.

2.2 Theory of Climate Change

Chamberlin argued in the late 1890s that the theory of climate change can be learned from the atmosphere's carbon dioxide content (Gilbert, 1956). Due to the general belief that long-wave radiation is caused by absorption from water vapor, which is similar to carbon

dioxide, this theory faced doubt over the years after gaining traction (Gilbert, 1956). Max Koch described climate change to be the direct effect of capitalism, as irresponsible capital accumulation often results in more GHG emissions. Simply because it favors economic growth over environmental protection (Cumo, 2012).

(Interpol, 2013) stated that theories around climate revolve around natural variability, anthropogenic factors, and polar amplification. (Sidiropoulos, 2023) Support this, and added greenhouse effect, anthropogenic global warming (AGW) adds greenhouse gas concentrations in the atmosphere. Climate change theories include concepts and practices that translate climate change effects and causes (UNHABITAT, 2019). Like the way atmosphere gases absorb heat, causing the global temperature to increase. With this knowledge, specialists in this area have stressed the need for adapting GHG emission reduction mechanisms to address climate change issues (Chassagneux et al., 2017).

2.3 Mechanisms to Reduce Emissions

While earlier works stressed designing emission reduction mechanisms that satisfied both Dominant Strategy Incentive Compatibility (DSIC) and Allocative Efficiency (AE), (Lakshmi et al., 2012) highlighted that there will be a budget imbalance when the two are both satisfied. (Lakshmi et al., 2012) Further suggested the use of a redistribution mechanism to minimize budget imbalance. This argument is in line with the notion that it is impossible to satisfy both Strict Budget Balance (SBB), DSIC, and AE at the same time.

Over the years, several mechanisms have been identified for reducing emissions, and among these is effective policy (Chassagneux et al., 2017); because policy can play a vital role in attaining swift and meaningful solutions to reducing emissions. A study by (Lin et al., 2014) highlighted the “Postponing Mechanism” and “Process Parameter Preliminary Optimization Mechanism (PPPOM)” and how effective they can be for optimizing results. While the former mechanism helps in delaying emission reduction processes when energy is less efficient, the latter helps with process parameters optimization at pre-emission reduction planning.

Recent literature, such as (Wang & Yi, 2023) stated that firm environmental regulations can be instrumental for effective “innovation compensation” in an urban cluster where development levels are low. Moreover, encourages industrial green improvement by reducing intense carbon emissions where development levels are high. Furthermore, (De Godoy & Saes, 2016) have identified several emission reduction mechanisms that are focused on emission trading systems, which include emission permit systems, ambient permit systems, and pollution offset systems. (De Godoy & Saes, 2016) Also outlined are primary regulatory

policies found in emission trading, such as, offset policy, bubble policy, netting policy, and emission banking.

The World Bank Group has been publishing annually on the state and trends of carbon pricing, wherein they highlight insights about carbon markets, including mechanisms to reduce emissions. Some of the main instruments focused on were direct carbon pricing, such as Emissions Trading Systems (ETSs) and carbon taxes and crediting mechanisms (World Bank, 2022, 2024). Such mechanisms are effective in promoting climate action as they provide incentives to reduce greenhouse gas emissions (World Bank, 2024).

As for the ETSs, these are mechanisms that use tradable emission units to limit emissions, providing means to allow entities to fulfill their compliance obligations (World Bank, 2023). Whereas for the carbon tax, this mechanism imposes a fee on emissions on emissions produced or on the emissions embodied in fuels (World Bank, 2023). These mechanisms are recognized as effective means to reducing global emissions; however, (World Bank, 2024) highlighted that more efforts are needed to meet the Paris Agreement goals. It further stated that there are a total of 75 carbon taxes and emissions trading systems globally, as of 2024. This number includes primary coverage in subnational governments and middle-income countries. See Figure 2.1 below for a detailed illustration of global GHG emissions covered by ETSs and carbon taxes.

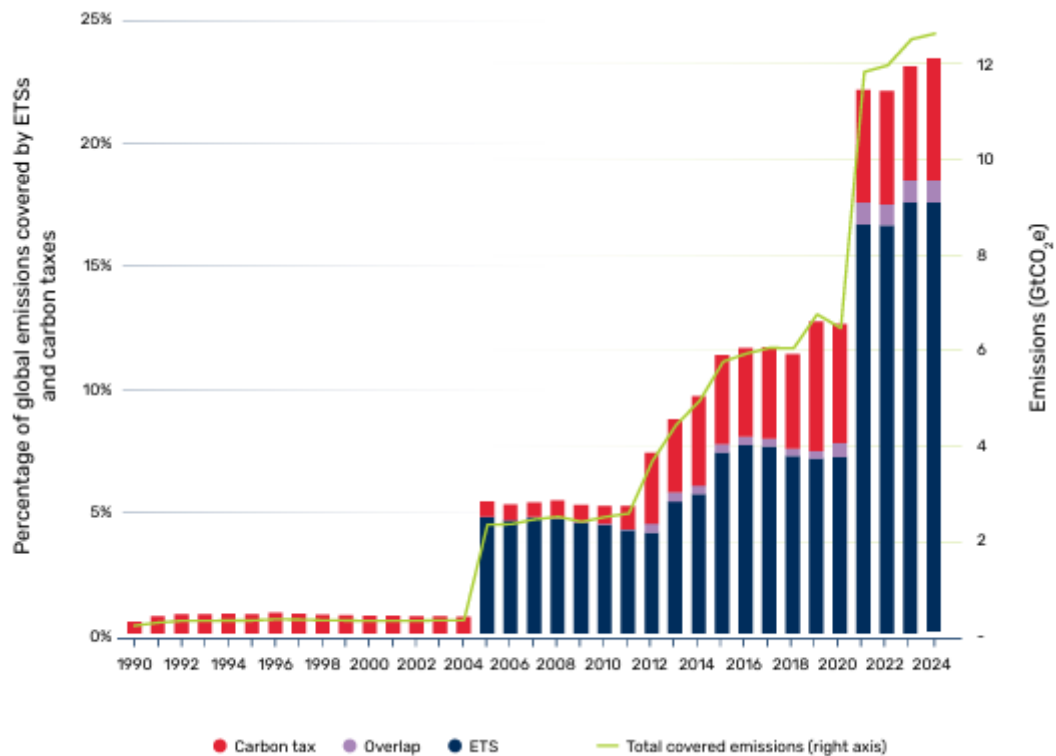


Figure 2.1 Global GHG emissions covered by ETSs and carbon taxes

Source: World Bank Group 2024

The framework of Paris Agreement Articles 6.2 and 6.4 also provides mechanisms that can be instrumental to attaining NDCs for emission reduction through carbon unit transfers (Schneider, 2019). They are deemed necessary because of their effectiveness in preventing double-counting issues. The emission trading schemes, such as the EU emission trading scheme (EU ETS) are also mechanisms considered effective for emission reduction (Chassagneux et al., 2017). Notwithstanding, the emissions under carbon pricing on the global level are unlikely to reach 30% in the short term despite the existing framework (World Bank, 2024). As a reference to (World Bank, 2023) report, the total amount of emission reduction covered by implemented carbon pricing instruments covered approximately 23% of GHG emissions globally. Although the context of revenue generated from carbon taxes and ETSs is significant, hence, it reaches about USD 100 billion, 40% of which was spent on green spending and 10% was used to compensate businesses or households (World Bank, 2023, 2024).

2.4 International Legally Binding

The impacts of climate change, particularly on the environment and economy, have triggered international agreements to enhance global climate actions through cooperation (UNHABITAT, 2019). The recognition of the global impact of UNFCCC interventions is all the result of the need for actionable mitigation of climate change impact on the globe (Interpol, 2013). To effectively address climate issues and ensure environmental sustainability.

Some key milestones have been reached over the years regarding international efforts toward establishing global environmental governance for climate change; among these are the 1972 United Nations Conference on the Human Environment and the Kyoto Agreement in 1997 (Zhao et al., 2023). As a result, Global Warming was established, and the European Climate Change Programme as well, which introduced the means to manage carbon emissions through a market in 2005. Shortly after, the 2012-2020 agreement on global emission reduction was subsequently negotiated at the 2009 Copenhagen World Climate Conference (Zhao et al., 2023). In addition, representatives from 195 countries geared toward tackling climate change approved the Paris Agreement in 2015.

A framework was drawn from the Paris Agreement that entails mechanisms for the international carbon market, and the framework consists of two key elements (Schneider, 2019). With the Paris Agreement Articles 6.2, 6.4, and 6.8, nations are provided with means for internationally transferred mitigation outcomes (ITMOs) and the sustainable development mechanism (SDM) (Zhao et al., 2023). These two elements of the Paris Agreement, i.e., cooperative approaches A6.2 and crediting mechanism A6.4, can be utilized through ETSs or cross-border government-to-government transfer (Schneider, 2019). Furthermore, these commitments help with maintaining environmental integrity and robust accounting measures to ensure that legally binding targets are met.

2.5 Lessons from Previous Research on Carbon Markets

Evidence has shown that economic theories and mechanisms dedicated to reducing GHG emissions were the focus of initial research on carbon markets (De Godoy & Saes, 2016). Some of this research evolved around market mechanisms, project-based emission reductions, cap and trade principles, and the existing literature that includes the Kyoto Protocol and Clean Development Mechanisms (CDM).

Research studies on carbon markets, including those set by regulations and those set on a voluntary basis, have pointed out many long-lasting issues. Carbon pricing methods can

be successful only if the rules and regulations are strong, the market guidelines are clear and there is solid cooperation among institutions (Kossoy & Peszko, 2016; Newell et al., 2013). Many scholars have stressed the importance of involving both the public and private sectors (Mohammad et al., 2022), having visible monitoring (Michaelowa, Hermwille, et al., 2019), and the risk that could arise from market splits (Ranson & Stavins, 2016). The situation is further aggravated in emerging economies by inadequate institutions and a lack of awareness among key stakeholders (Dixit & Bardiya, 2024). Examples from the EU, California, and China reveal that planning, small-scale pilot trials, having strong MRV, and being flexible in policy design are essential (Ellerman et al., 2019; ICAP, 2023).

Various studies have pointed out doubts in the performance effectiveness of the CDM, with evidence that a huge percentage of credits, in particular, the EU ETS, do not administer additional emission reduction (Kerr, 2022). However, some evidence has been presented that real additional emissions were reduced from California's forest offset. Subsequently, previous studies have also shown a significant growth in the implementation of carbon pricing instruments in both national and sub-national jurisdictions (Chassagneux et al., 2017).

According to (Kerr, 2022), in his recent study, it was highlighted that additionality and various standards utilized in offsetting can influence the environmental integrity issue of carbon offset. Notwithstanding, Suggestions were made for a global improvement of the carbon market landscape, which has the potential to address 12% of the global emissions, valued at around \$50 billion (Chassagneux et al., 2017). Moreover, the study done by (De Godoy & Saes, 2016) presented a comprehensive analysis that eases the understanding of carbon markets. It further underscored both their pros and cons and provided a roadmap for future development.

It is imperative to learn from past experiences such that they can present some important lessons that can help in ensuring an effective international carbon market, particularly in the aspect of cooperative approaches and crediting mechanisms (Schneider, 2019). The effectiveness of such markets depends on the valuation of environmental integrity and regulatory lapses. (World Bank, 2018) highlighted lessons drawn from the markets under the Kyoto Protocol that the Paris Agreement can take into account when developing new carbon market mechanisms. These lessons include the importance of robust design to ensure trust and integrity, the urgency of domestic policies, path dependency, and flexibility to learn from lessons to guide future policymaking. In addition, lessons from experience have stressed the need for additionally, mitigation actions verification and the attainment of real, measurable, and long-term benefits from various mechanisms (Schneider, 2019).

Carbon markets, developed to address climate change, have become vulnerable to fraud and manipulation. Both ETS schemes and offset markets have experienced cases of fraudulent activities (Martin & Walters, 2013). These frauds are considered an inherent feature of carbon offset markets, rather than isolated incidents that can be eliminated through regulation (Martin & Walters, 2013). The risks of carbon fraud are particularly concerning in developing countries, where the implementation of carbon pricing mechanisms is still in its early stages (Johari & Shuib, 2021). Furthermore, (Michaelowa, Shishlov, et al., 2019) highlighted several regulatory challenges and lessons learned, which include the need to address supply-demand balance, transaction costs, and environmental integrity.

Although there is potential for carbon pricing to have multiple benefits, including economic growth and improved equality, its effectiveness depends on well-designed policies tailored to each country's socioeconomic circumstances (Johari & Shuib, 2021). The offset carbon credit market, largely unregulated, has realized an increase in carbon brokers offering various offset products, further increasing the risk of fraudulent activities (Martin & Walters, 2013). As carbon markets continue to evolve, addressing these fraud risks remains a critical challenge for policymakers and market participants (Plaza Calle et al., 2024). Notwithstanding, several studies have discussed various lessons learned from the design and implementation of carbon markets. These lessons include challenges in pricing mechanisms, standards, policies, and more.

Subsequently, (World Bank, 2022) draws lessons from various countries and jurisdictions such as the Californian ETS and offset program, Chile, the European Union's ETS and Offset, South Korea's ETS, and New Zealand's ETS. More lessons are highlighted from markets like The UK ETS, Mexico, Alberta cap-and-trade program in Canada, Australia's Carbon Farming Initiative, The Brazilian Amazon fund, The California Air Resources Board (CARB), the renewable energy initiative in India, and also from The Clean Development Mechanism (CDM) (World Bank, 2023, 2024). See Table 2.1 below for details of the lessons learned from the design and implementation of carbon markets from different countries or jurisdictions.

Table 2.1 Lessons Learned from the Design and Implementation of Carbon Markets

Markets	Lessons	Countries or Jurisdictions
	Clear regulatory Framework: It is important to have a well-defined regulatory framework to successfully operate an ETS. A principal example of a jurisdiction that designed a comprehensive legal and regulatory structure to guide its cap-and-trade program is California. Flexibility Mechanisms: To enhance the resilience and adaptability of the ETS, California's cap-and-trade system employed the incorporating flexibility mechanism that allows banking and borrowing of allowances. Robust Cap Setting: It is crucial to have a well-defined and reliable emission cap to maintain integrity in the ETS market. The EU ETS has shown that emissions can be significantly reduced over time when there is a stable cap. Stakeholder consultation: During the design and implementation phase, it is important to engage key stakeholders in order to capture various issues and address them accordingly. To help create a more inclusive approach, Australia conducted extensive consultation processes during the development of its carbon pricing mechanism. Alberta's cap-and-trade program in Canada also did an extensive stakeholder consultation during its design. Monitoring and compliance Mechanisms: To ensure that emissions reductions are achieved, it is crucial to have robust monitoring and compliance systems. The UK Emission Trading Scheme was able to maintain integrity in its system by focusing on strengthening its monitoring and compliance	California USA The European Union Australia & Canada UK

	mechanisms. The UK also employed effective market oversight to ensure compliance and prevent manipulation by implementing robust monitoring and reporting frameworks. Market Stability Measures: To avoid issues related to market volatility, implementing measures such as price floors or ceilings can help stabilize the market. Such mechanisms were used in Quebec's ETS to minimize fluctuations in prices and build confidence among participants. International Linkage: A means to reduce compliance costs and improve liquidity can be achieved through linking with other carbon markets. An example of this was how the joint program between California and Quebec linked ETSs to broaden their market access and enhance efficiency.	Quebec California and Quebec Brazil
Offsets	Alignment with Additionality Criteria: Offsets have to show additionality, i.e., they have to provide more benefits than would have happened in the absence of the project. The Brazilian Amazon Fund has been keen on making sure that the financial incentive brings about new conservation measures that otherwise would not have occurred. Market Dynamics: The Voluntary Carbon Market functions with a different dynamic, and both compliance and voluntary market interactions in jurisdictions like Brazil have influenced the price and demand of offsets. Credibility and Transparency: The credibility of offset projects can be guaranteed with the help of transparent approval and monitoring of the projects to keep the markets confident. To provide transparency and integrity in its offset program,	California

2.6 The Net-Zero Roadmap to Achieving Global Target

A net-zero roadmap can be considered as a guiding strategy regarding the process of arriving at a marked decarbonization in fossil fuel dependence (Beckmann et al., 2023). It sets out a thorough plan of measures and policies to realize net-zero greenhouse gas (GHG) emissions. The term structure usually contains a powerful policy framework, efficient verification process, dynamic stakeholder interaction, reporting, and monitoring systems, and progressing of relevant technologies (De Godoy & Saes, 2016). Being strongly interconnected with the promises established in the Paris Agreement, the net-zero roadmap focuses not only on the short-term mitigation but also on the long-term net-zero goal (Beckmann et al., 2023).

The beef and dairy industries have been covered using a sector-specific adaptation of this road map, in the United States beef and dairy industries, and focused on the sustainability of agricultural practices. This version puts an emphasis on expert consultation in order to achieve the development of effective GHG reduction strategies (Vargas et al., 2024). It is based on the partnership between the scientists, producers, and the stakeholders in order to define clear objectives and realistic strategies. Since food systems contribute about a third of emissions globally, the industry is in the process of ensuring that it is net-zero in terms of emissions by 2025 (Costa et al., 2022). In different contexts, the net-zero roadmap invariably prioritizes the necessity of such game-changer investment in technology, the energy system, the product design, the value chain, and the regulatory framework as indispensable measures on the way to substantial reductions in emissions (Beckmann et al., 2023).

2.7 Regulation to Support Carbon Exchange:

Adequate regulation is pivotal to the formation and functioning of the carbon markets. As an example of a successful system, such as the European Union Emissions Trading System (EU ETS), the regulatory framework is strong and within the domain of control of the European Commission, guaranteeing uniformity and responsibility between the member states (Chassagneux et al., 2017). According to the (World Bank, 2018), an effective carbon market must have well-established rules and regulations, active market supervision, smooth access to participants, and be aligned within jurisdiction to facilitate assurance and functionality. The political system that supports the EU ETS and all following Directive 2003/87/EC enables the accomplishment of important details of this regulatory framework like permit distribution, permit compliance, and allowance auctioning (Chassagneux et al., 2017).

Regulatory clarity and implementation power, as applied to the EU ETS, are imperative in making the cap-and-trade system a success or even successful at all, due to the

fact that they make the emission caps believable, not to mention enforceable (Lakshmi et al., 2012). Likewise, it is in the carbon policy of the United Kingdom whereby the effective regulatory framework has led to the overall observation of sufficient representation and advice of diverse stakeholders or parties in its effort to achieve the effectiveness of its regulations (World Bank, 2022). An open, legally valid framework is far more critical both to compliance but also to the development of confidence between the players in the marketplace.

As the example of the EU ETS shows, a well-functioning carbon trading can find its support through a well-built legal and institutional framework. It incorporates compliance systems, monitoring mechanisms, and accountability procedures; which are all participatory towards the stability of the market. The (World Bank, 2024) also emphasizes that a combination of legislation, operational guidelines, and policy instruments are necessary when it comes to creating an efficient regulatory framework. Among them, they should feature enforcement mechanisms, transparency practices, safeguards of market integrity, and stakeholder engagement approaches that contribute to an effectively integrated and reliable carbon market (World Bank, 2022, 2024).

Effective regulatory frameworks, especially administered under the Paris Agreement, are vital towards enhancing carbon markets transparency, accountability, and integrity (World Bank, 2018). Adequately made regulations not only regulate the work of the market; they also promote more collaboration between parties, which eventually contributes to the wider objective of decreasing the quantity of greenhouse gas emissions (Chassagneux et al., 2017). In addition, the environmental policies can also become a major driver of innovation and a sustainable way in terms of promoting the carbon trading mechanisms and low-carbon technology indirectly (Wang & Yi, 2023).

The United Nations Framework Convention on Climate Change (UNFCCC) also enhances global regulatory coherence since it offers both tools and forums where national emissions targets, climate resilience, and financial and technological support, particularly of developing nations that aim to undertake climate actions can be established (UNHABITAT, 2019). Combined, these frameworks provide a legal and institutional framework required to advance powerful and fair carbon exchange systems. See Figure 2.2 below for an Overarching compliance and monitoring structure.

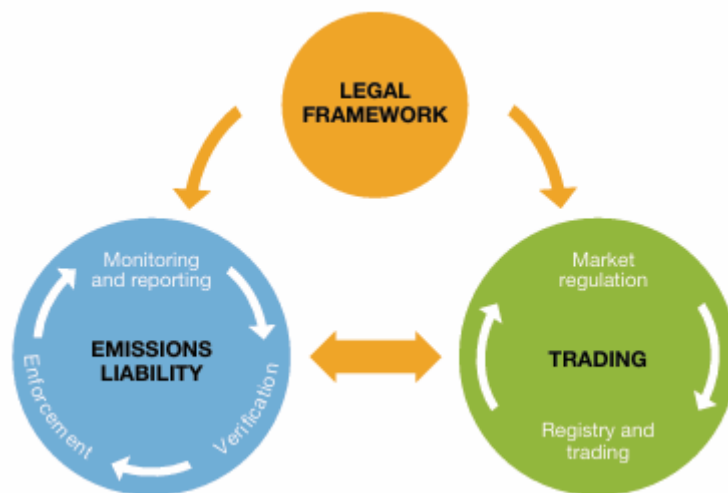


Figure 2.2 Overarching compliance and monitoring structure
Source: World Bank Group 2023

2.8 Risks in Carbon Market (Fraud and Beyond)

There is a large group of publications that point out the risks associated with carbon markets. Among these risks are challenges with technical criteria, regulators' influence, and effective monitoring, plus dishonest acts such as greenwashing and fraud (Carton et al., 2021). (World Bank, 2022) has highlighted cases of false reporting and the issuance of inauthentic carbon credits. (World Bank, 2022) further underscored the importance and need to have robust verification and monitoring systems to mitigate these risks. Drawing an example from California's cap-and-trade program, which was able to detect and prevent market manipulation practices through regulatory oversight (World Bank, 2023).

A few risks linked to carbon markets, such as fraud and other issues, were outlined by (World Bank, 2023). The following risks and challenges were determined, such as risks of credibility and reputation, registry errors, policy risks, and technological risks (World Bank, 2023). False transactions may destroy the reputation of carbon markets (World Bank, 2022). There has been a reduction of trust in a number of compliance and voluntary markets because of non-eligible credits, out-of-order use of the same figures, or not doing all checks. Market volatility in terms of altered prices (Bayer & Aklin, 2020), poor legislation, and the absence of the appropriate scope to apply it are the threats involved. The emergence of a strong carbon market in Indonesia cannot be assisted owing to poor institutional coordination and the lack of experience in the field of managing the market processes. It is against these challenges that there should be an intention to identify and preemptively address potential risks to attempt to

build a carbon trading framework that can aid both environmental sustainability and economic resilience.

One of the causes of the threats of fraudulent activities in the carbon market is the weak regulatory systems in various jurisdictions (Interpol, 2013). Such loopholes raise the risk of fraud in the issuance and trade of carbon credits, which may even lead to fraud. According to (Kerr, 2022), purchasers of carbon offsets can lose their money when they purchase unreal or fake credits. To ensure that these risks are reduced, it is frequently advised to implement the third-party verification process and independent audit (Kerr, 2022). The typical flaws of the carbon markets are a lack of clarity and transparency, the lack of certainty about the validity of the given credits, ineffective regulation, and the concerns that can be caused by the previous fraud and unethical cases (World Bank, 2018)..

Carbon trading in such sophisticated markets as the European Union Emissions Trading Scheme (EU ETS) has also been challenged by fraudulent activities. There are a number of well-known fraud cases in the EU ETS: infamous Value Added Tax (VAT) carousel fraud and theft of emissions allowances (Weishaar, 2017). VAT fraud, which took place primarily at the end of 2008 and the beginning of 2009, not only affected the functioning of the market but also the pattern of trade and the confidence in the market (Frunza et al., 2010). These incidents pointed out the critical flaws in both the registry and oversight system of the EU ETS (Weishaar, 2017). The European Union responded to this by announcing regulatory reforms to reinforce the system that include updating the Registry Regulation as well as strengthening financial market regulation. However, other stakeholders have raised issues about the effectiveness of such reforms and the increased regulatory burdens that they are likely to create among the players in the market (Weishaar, 2017). Fraud in carbon markets is also a complicated phenomenon that has proved problematic when it comes to investigating and prosecuting, as seen in the debate on how to increase criminal law partnerships among EU Member States (Weishaar, 2017).

The exploitation of the carbon market and tax fraud have a high tendency to increase when national and regional markets are integrated without robust regulations (Interpol, 2013). For example, the 2009 case that tied organized crime was associated with carousel fraud, making massive trading on France's BlueNext carbon exchange. (FATF, 2020) In their 2020 report, they highlighted the need for vigorous legal frameworks to combat crimes associated with the environment and fraud. The 2009 case alone cost various governments projected losses of around 5 billion euros (Interpol, 2013). While on a yearly basis, environmental criminal enterprises gain around USD 110 to 281 billion from activities such as illegal logging,

wildlife trade, and waste trafficking (FATF, 2020). Underscoring the need for regulators to prevent fraudulent activities by providing solutions to these vulnerabilities that hamper the effectiveness of carbon markets.

As underscored by (Schneider, 2019), fraud can undermine the overall effectiveness of carbon market mechanisms. Hence, it is important to be vigilant for things like misreporting of emissions and reductions, credits and offsets misuse, Caps in verification protocols, and accountability issues to identify potential fraud (Costa et al., 2022). (Schneider, 2019) Recommended the implementation of strict accounting practices and verification of traded units for risk mitigation. In addition, (Costa et al., 2022) suggested the use of transparent methodologies, effective regulatory structures, and strict monitoring and verification processes for risk mitigation. (Schneider, 2019) Also stressed taking measures such as transparency and rigorous oversight to avoid fraudulent activities.

2.9 Overview of the Carbon Market

Carbon markets such as emission trading systems (ETS) and offsets are effective in reducing greenhouse gas emissions. Subsequently, in 1997, the Kyoto Protocol established the mechanism of trading emissions between its participants. By 2005, other jurisdictions, such as the European Union and Norway, had designed domestic ETs, and Japan had introduced a voluntary trading scheme (World Bank, 2021). While the cap-and-trade scheme allows companies to trade allowances within their emission limits (King, 2008), project-based offsets allow the generation of carbon credits from projects that support emission reduction (Godoy, Gurfinkel Marques de Saes, 2015). As of 2020, 28 various ETs have been developed around the world, as indicated in Figure 2.3, with lessons drawn from both proposed and repealed policies (World Bank, 2021). (World Bank, 2021) further disclosed that the design of ETs is linked to the overall global climate policy framework, especially regarding Article 6 of the Paris Agreement, which encourages voluntary mitigation cooperation and integrity of carbon pricing systems.

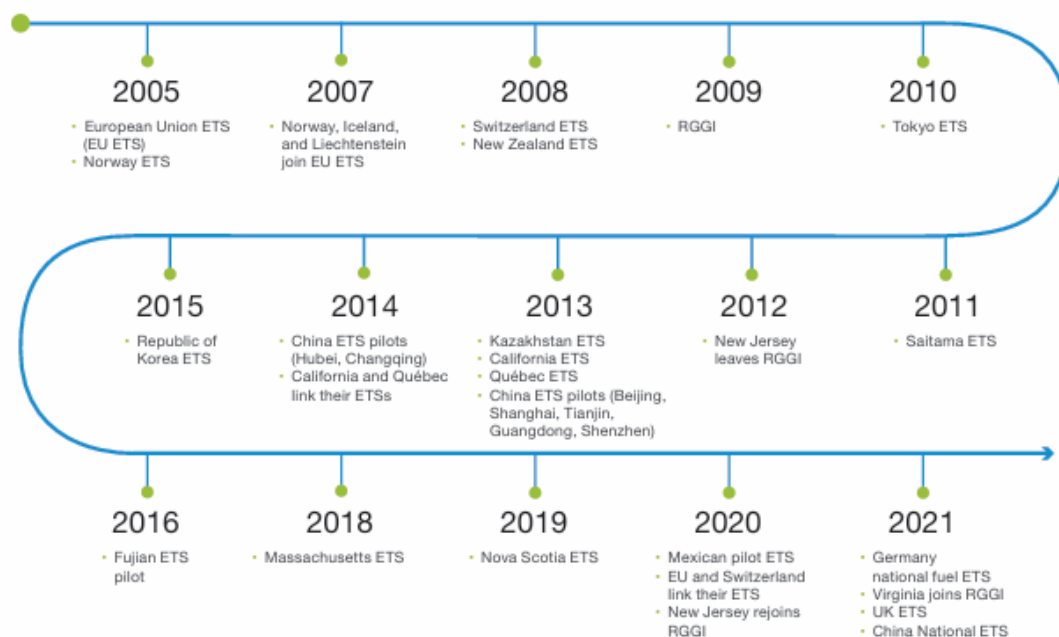


Figure 2.3 Establishment of ETSs worldwide over time

Source: World Bank Group 2021

Carbon trading systems of various types from international, regional, and national levels have been established, showing different systems and the differences in their design and functions (Hasselknippe, 2003). However, the effectiveness of these markets is determined by their design in ensuring environmental integrity and lower cost (Betz et al., 2022). Lessons on designing capable markets can be drawn from the European Union Emission Trading System (EU ETS) (King, 2008). As ETSs globally increase, governance of offset programs must be well-established. Because this will ensure that emissions reductions are credible, genuine, and aligned with the objectives of the Emissions Trading Systems (World Bank, 2021).

The methods of allocation, connections to external systems, and how the credits from projects are used should be primary factors that require consideration when designing the carbon market (Hasselknippe, 2003). Offsets from agricultural activities have the potential supply; however, some difficulties lie in their implementation, particularly the transaction cost and designing the contracts (Gonza et al., 2012). Although their designs and functionality are different, carbon markets are evolving towards integration and harmonizing various existing systems, especially after the EU ETS agreement (Hasselknippe, 2003). With the use of blockchain technology, there is a potential for improving the transparency and effectiveness of carbon markets, especially in sectors like forestry and renewables (Vilkov, 2023). Notwithstanding, due to blockchain being relatively new in carbon markets, this makes it

challenging to be fully utilized. As climate policies evolve, policymakers need to know the complexities of these markets (Gonza et al., 2012).

2.10 ETS and Offset Systems

Two systems are available to reduce greenhouse gas emissions: Emission Trading Systems (ETS) and Offset systems. As stated in (Wicaksono, 2024), ETS refers to a regulatory mechanism that limits the total amount of emissions of all corporations. Each company has an allowed limit of its emissions, and those companies that have exceeded their limits are allowed to purchase permits or credits from other company which has a limit of emissions lower than their allowance limit. Other literature referred to ETS as a form of control by making it possible to trade in emissions allowances, which are permits, as the emission of a company to produce an amount of greenhouse gases in a specific period of time (Purnamasari & Nurachmah, 2023). (Dewi & Dewi, 2022) Noted something similar in the provision of Emissions Trading Systems: they are implemented as a market-based tool through which economic incentives are offered to reduce emissions of greenhouse gases. This will encourage firms to control their emissions as well as make the process flexible and economical (Aptasari, 2024).

The EU ETS, as described by (Kristianto, 2024), is based on a cap-and-trade principle. It sets a limit on total emissions for covered sectors and distributes emission allowances to participating entities. These allowances can be traded in the market, creating financial incentives for entities to either reduce their emissions or acquire additional allowances when needed. The cap establishes the maximum allowable emissions, which are gradually reduced over time to support climate targets. ETS units represent these allowances and are linked to emissions from specific sectors, companies, or regions. Organizations that exceed their permitted emissions must obtain extra allowances through market transactions, whereas those that emit less than their cap can sell their surplus units.

The ETS units trade between market players with various emission demands and engage EUA (European Union Allowances), CER (Certified Emission Reductions), and ERU (Emission Reduction Units) (Aditwarman, 2024). Moreover, Regulated entities buy these permits either from the government or in the secondary market; in the latter, they can trade permits with other entities (S. & B., 2023). An adequately designed cap-and-trade system, like the EU ETS, may offer flexibility to regulated actors, attract innovative ways to mitigate the problem, reduce carbon emissions at a lower cost, and ensure a shift towards low-carbon energy and production systems (Kristianto, 2024).

Offset systems, on the other hand, allow individuals or entities to invest in or undergo emission reduction activities outside of their own operations to offset their emissions (Aptasari, 2024). For example, if a company is unable to reduce its own emissions to meet its targets, it can invest in reforestation projects or renewable energy initiatives that result in equivalent emissions reductions elsewhere (Aptasari, 2024). Emission reductions generated by projects can be sold as carbon credits. See Figure 2.4 for an overview of Offset programs around the world.



- 1 - California and Québec allow offsets mutually sourced from linked jurisdictions
- 2 - The Swiss and EU ETS no longer use offsets from 2021
- 3 - New Zealand may readmit international offsets contingent on access to high integrity sources
- 4 - Korea allows domestic credits as well as international CDM credits developed by Korean companies
- 5 - Nova Scotia's cap-and-trade legislation includes provisions for an offset program, however as of 2020 the program is not yet operational

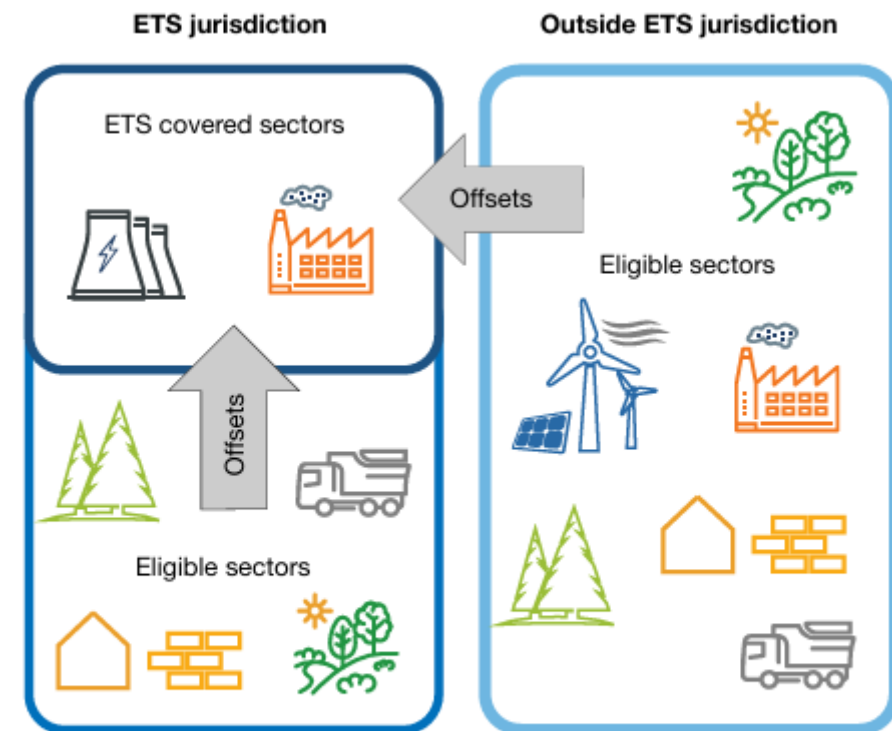
Figure 2.4 Offset programs around the world

Source: World Bank Group 2021

At the heart of voluntary offset systems, projects that deliver additional emission reductions not required by regulation can generate credible offset credits (Wicaksono, 2024). (Wicaksono, 2024) further stated that offset systems provide a mechanism for companies to

provide emission reduction by reducing Cascade, offsetting their emissions by reducing emissions elsewhere that are not included under the regulatory mechanism. Such offsetting is expected to reduce costs for the company to a certain level while offsetting their emissions. This creates an incentive system for companies to invest in environmental projects, while also providing an option for entities to reach their emissions goals at a lower cost (Aptasari, 2024).

Offsets are credits generated from activities that avoid emissions, reduce emissions, or remove GHGs in another sector. Offset credits can then be sold or traded in the carbon market to entities participating in the ETS for compliance purposes (S. & B., 2023). These systems are suitable for the global south as they aim to reduce GHG emissions in other sectors or countries that may offer lower GHG abatement costs than those facing the regulated entities (S. & B., 2023). Furthermore, Offsets refer to emission reductions generated by projects implemented in sectors that are not covered by the cap-and-trade scheme and can be used to comply with a part of the covered entity's obligations. For example, an organization can fund a renewable energy project in another part of the world and then use the resulting carbon credits to offset the emissions that it is producing (Kristianto, 2024). See Figure 2.5 below for examples of the sources of offsets used in various ETSs globally (World Bank, 2021). According to (Aditwarman, 2024), The host country authorizes verified emissions credits, which are then traded in carbon markets. Examples of offset standards include the Gold Standard, VERRA, Climate, and Community and Biodiversity Standards.



Note: Sectors need to be deemed eligible by the ETS jurisdiction.

Figure 2.5 Sources for offsets for an ETS

Source: World Bank Group 2021

As stated by (S. & B., 2023). Offset systems aim to reduce GHG emissions in other sectors or countries that may offer lower GHG abatement costs than those facing the regulated entities. (Syahrudin et al., 2024) Highlighted that in most offset schemes, a third-party certification system will verify the legitimacy of the emissions reduction generated by the offset project. The generated carbon credits can be traded in the marketplace as a commodity and can be used by companies or governments in the future to offset emissions that they cannot reduce on their own. Some examples of offset projects may include afforestation, reforestation, energy efficiency improvements, and renewable energy deployment, amongst others (S. & B., 2023). Carbon capture and storage, reforestation, or renewable energy projects are other examples of these projects, which reduce greenhouse gas emissions (Bryant, 2019).

The Clean Development Mechanism allows Annex I countries to invest in emissions reduction projects in developing countries to generate offset credits against their emissions

reduction commitments (Ludeña et al., 2016). (Kristianto, 2024) argued that Offsets aim to incentivize emissions reductions in sectors that are more challenging to regulate or where implementing emissions reduction measures is more expensive, by providing additional funding sources for such projects (Kristianto, 2024). However, offsets have faced criticisms and challenges regarding their design, additionality, and verification, which need to be addressed to ensure their effectiveness in contributing to overall climate change mitigation efforts. These Carbon Market Mechanisms offer a unique mixture of economic, environmental, and social benefits that can inspire and enhance climate-resilient development paths consistent with the Paris goal (Wicaksono, 2024).

Another key important element for both ETS and offset markets is the carbon credits, which represent the right to emit one metric ton of carbon or its equivalent in other greenhouse gases (World Bank, 2024). The World Bank provides insights on the demand and supply drivers and dynamics for a better understanding of how carbon credits function in both compliance and voluntary markets (World Bank, 2024). The issuance and retirement of credits were also discussed, stating that carbon credits are issued based on verified emissions from specific projects (World Bank, 2023). Just like the general market, the carbon credit market also faces challenges, including issues of transparency, credibility, and market volatility. However, it also presents opportunities for innovation, investment, and promotion of green technologies that can foster a low-carbon economy (World Bank, 2023). Based on demand drivers, four market segments are identified, and these include international compliance, domestic compliance, voluntary, and result-based finance (World Bank, 2024). See Figure 2.6 below for the types of carbon crediting mechanisms and market segments.

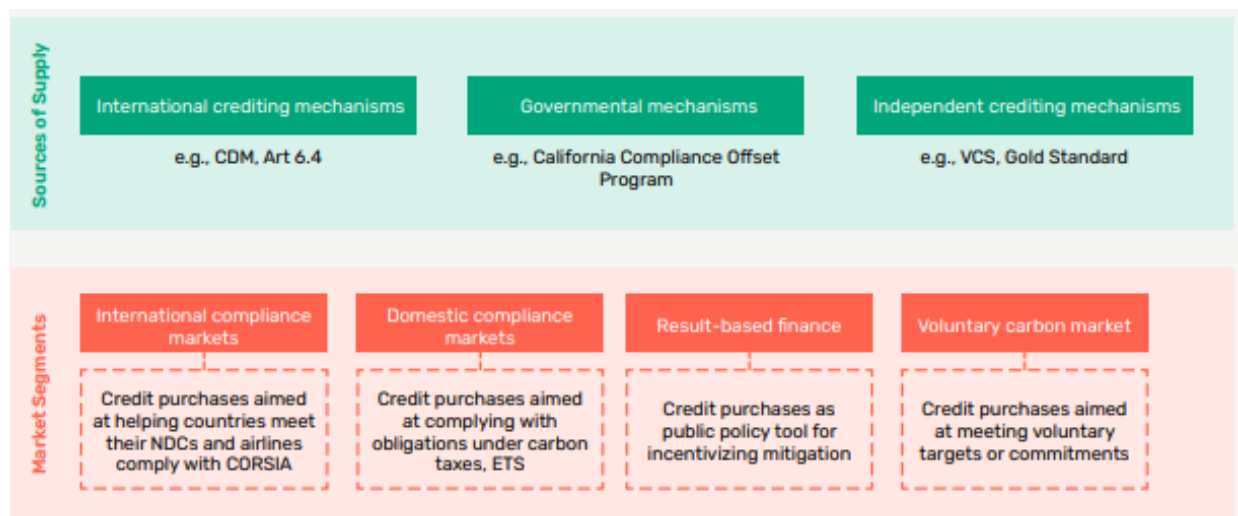


Figure 2.6 Types of carbon crediting mechanisms and market segments

2.11 Systems Design and Role in Emission Reduction

The design of these systems is crucial to their success in reducing emissions. For instance, ETS must have a realistic and enforceable cap that is periodically reduced over time to ensure emissions reductions align with climate goals (Aptasari, 2024). Under ETS, the demand is created for carbon permits, while for offsets, the demand is created for credits. This drives technological innovation and the adoption of less carbon-intensive practices while reducing GHG emissions (S. & B., 2023). In addition, there must be transparency, clear rules, monitoring, reporting, and verification systems that ensure the validity of the allowances' emissions reporting. More than that, a clear and regulated penalty for non-compliance must be in place. Both ETS and offset systems have a significant role in reducing emissions. ETS provides flexibility for companies to reduce emissions while minimizing compliance costs, and offset systems provide an incentive for entities to invest in emission-reducing projects or technologies (Asih, 2024).

As far as the designs go, It is recommended that the regulatory frameworks for both systems should be designed and implemented effectively so that they travel in the right direction, sustainably and fairly (Wicaksono, 2024). It is also important to note that even a well-designed ETS will have to change over time to remain effective (World Bank, 2021). (World Bank, 2021) Further highlighted 10 steps that can be applied to design ETS, with emphasis on ongoing evaluation and implementing the steps to ensure effective changes take place robustly and practically. See Figure 2.7 for a detailed illustration of ETS design in 10 steps. Effective implementation of these mechanisms depends on creating an excellent network of support and service providers to provide up-to-date knowledge of issues related to carbon credits, and carbon offsets, and provide transparency in reporting, including the assurance of high-quality data and independent third-party verification, which will increase the uptake of robust and effective emission reduction practices (World Bank, 2021).

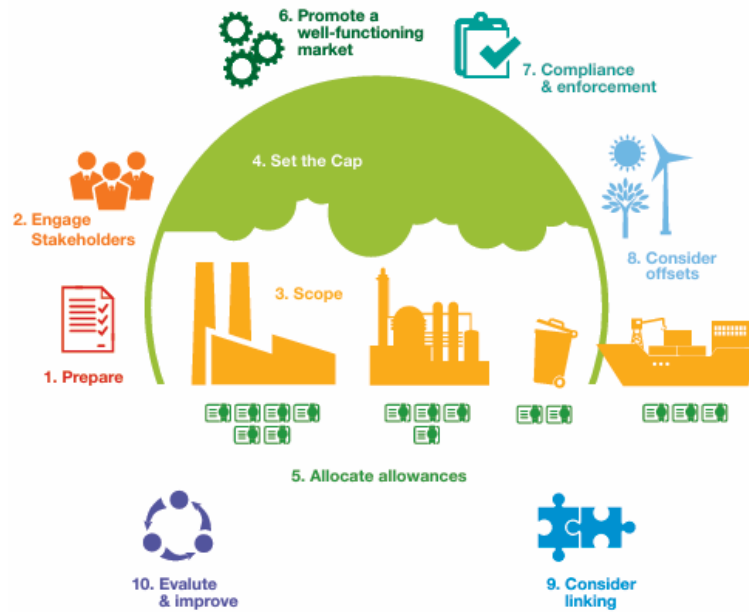


Figure 2.7 ETS design in 10 steps

Source: World Bank Group 2021

In ETS, the cap's stringency and allocation methods are crucial. In contrast, offset systems need to ensure that the credits represent a real, additional, and measurable emission reduction (Asih, 2024). In offset systems, however, there must be a rigorous certification process to ensure the validity and quality of credits from offset projects (Aptasari, 2024). (Aptasari, 2024) suggested that the criteria and criteria for offset projects must be clear, consistent, and transparent, and the projects must credibly reduce emissions beyond regular incentives to avoid double-counting and ensure the veracity of reductions. ETS and offset systems' designs can vary, but they need to ensure adequate environmental integrity, avoid double counting, and evaluate the additionality of offset projects (Asih, 2024).

Both the ETS and offset systems play a role in emissions reductions. In the ETS scheme, the system puts a price on carbon emissions in the market, which generates an incentive for firms to reduce their emissions (Bryant, 2019). They are also promoting innovation on climate-friendly technological reduction of GHG emissions at a lower cost (Syahrudin et al., 2024). Offset systems also provide incentives to reduce emissions because they allow firms to offset their emissions through carbon credits or the purchase of carbon credits in a sustainable carbon reduction project, which would never exist without financing.

As (Ludeña et al., 2016) affirms, Emissions Trading Systems (ETS) as well as carbon offsets demonstrate a more economic way of minimizing greenhouse gas release than the

traditional regulatory procedures. Creating a carbon market, ETS efforts will lead to the appropriation of the low-emission technology, as well as permit the reduction of emissions where economically advantageous to do so, which can be helpful in accomplishing the global objective of climate action. The complementarity of offsets, notably in developing nations, is the promotion of investment in cleaner technologies and the provision of cost-effective alternatives to the traditional mitigation measures. Altogether, both ETS and offset systems can be effective means through which emissions can be reduced, either by means of which parties earn money as incentives from reduced emissions or by recompensing for inevitable emissions (Syahrudin et al., 2024).

However, there are issues associated with the offset programs, such as claims of transparency and accountability that may present loopholes that can be used by fraud artists or other problems related to a lack of credibility. Like (Bryant, 2019) warned, the success of both ETS and offset systems will be determined by the effectiveness of the design and the way they operate in eliminating such weaknesses. Clear and rigorous standards are necessary to be accurate, transparent, and accountable when conducting their application. There should also be high regulatory control to prevent fraud, and these projects on carbon offset should be able to offer measurable and extra environmental benefits (Ludeña et al., 2016).

Such are the market-based mechanisms giving the possibility to determine and implement the most economical emission reduction methods. They enhance national climate targets by helping to cut down emissions of greenhouse gases at a scale and cost-sustainable way by making the broad engagement of sectors possible (Syahrudin et al., 2024). Although ETS and offsets both work in regulated structures, each of the two has distinct characteristics in terms of design and implementation. How effective they become relies on the ability of the concerned institutions to ensure effective adherence and see them internalize the environmental cost of their operations (Aditwarman, 2024). The set of strengths of the two systems is balanced with the set of implementation problems and issues that have to be resolved to reach the full potential of emissions reduction (Aptasari, 2024).

2.12 The Role and Limits of Regulatory Frameworks in Carbon Market Development

The regulatory framework is important in establishing long-term stability of carbon markets and developing trust. It gives a legal and institutional foundation to carry out upscale monitoring, reporting, and verification (MRV) systems, run trading facilities, and enforce compliance (World Bank, 2021). Nevertheless, the literature defines a number of similarities among regulatory weaknesses, including the duplication of various functions assigned to the

institutions, low functionality, and pace in reflection of the arising realities in the market. To illustrate, earlier in the lifespan of the EU ETS, regulatory failures were a factor that abetted a number of issues such as tax fraud and the over-allocation of emission allowances (Michaelowa, Hermwille, et al., 2019). These problems are aggravated by the inability to coordinate activities across agencies and to achieve national policy-to-global framework consistency in the case of developing countries such as Indonesia (World Bank, 2022). Thus, a sensitive balance between the strictness and adaptability is needed in an effective regulation, as it will provide the balance between compliance and market flexibility.

Experience around the world has evinced a number of important elements of effective regulatory design. These include consist of the provision of regulatory flexibility, ease in rules, involvement of stakeholders, the need to combine climate policies, and prepare specific rules of how to monitor and report emissions (Michaelowa, Shishlov, et al., 2019). The literature also states the importance of restricting free allowances as well as control of carbon prices, jurisdictional clarity, and facilitation of voluntary connection of trading systems (Newell et al., 2014). In a subsequent work, (Newell et al., 2014) emphasized the necessity of the similar regulatory efforts to adjust with time, and the proposed focus of the EU ETS on avoiding phenomena like credit recycling was highlighted (Newell et al., 2014). In the case of Indonesia, some weaknesses still exist, such as unclear roadmap, carbon exposure thresholds that are vague, and lax enforcement of the laws. These are also imperative in enhancing the effectiveness and credibility of the carbon market in Indonesia (Sofiyati & Hernawan, 2023).

Fraud has become an affliction that is of serious concern in the European Union Emissions Trading Scheme (EU ETS), especially with the expanded market and economic importance. Cases of value-added tax (VAT) carousel fraud and illegal claims of emissions permits have highlighted some major vulnerabilities in the supervision and online registries of the system (Weishaar, 2017). It is such weaknesses that have highlighted the need to have more rigorous regulatory frameworks to safeguard the integrity of the market. To act against this, the EU has implemented some regulatory changes on supranational and member-state levels to tighten control and diminish the vulnerability to the risk of financial activities (Weishaar, 2017).

The bottom-up governance system of the Paris Agreement has also created additional problems with the coordination of cross-jurisdictional issues. This has introduced new issues pertaining to the harmonization of carbon trading regulation and policies to be put in place to facilitate international connection (Zaman & Adam, 2016). Other researchers have suggested that the development of irregularities and scams in the carbon market could be indicative of

structural malfunctions, not simply isolated ones (Martin & Walters, 2013). It is also held in this view that regulation can, on its own be inadequate, particularly when wider aspects of systemic and political-economic sense are not put into consideration.

Regulatory dilemmas have also been displayed in the experiences of other countries. Such an example is Peru, which has one of the first experiences with the REDD+ framework, aiming at creating a legislative infrastructure regarding its carbon market with the establishment of a National Registry of Mitigation Actions (P. & J.P., 2022). Nevertheless, even after this advancement, doubts continue, especially when it comes down to what is to be done to hold emission reductions made under projects not listed within the formal registry. This indicates the larger complexity of carbon markets where technocratic design meets politics of institutions, law interpretation, and knowledge and power contestation (P. & J.P., 2022). The cases bring to the table the necessity of flexible, transparent, and binding regulations to mitigate fraud and safeguard the long-term usefulness of the carbon trading systems.

2.13 Technological Interventions

The benefits of blockchain in transforming the carbon markets and emissions trading systems, such as ensuring overall transparency, efficiency in operating and instilling trust among the stakeholders, are increasingly being realized. As explained in (Vilkov, 2023), a decentralized model of blockchain can add value in renewable energy and the forestry sector, particularly in areas where carbon offset programs are emerging. The possibility to support interoperability within fragmented carbon markets, even in cases when standard legal frameworks are not applicable. And also urbanizing the verification and trade activities can be regarded as one of the most promising features of it (Jackson et al., 2018). However, achieving mass adoption of blockchain within this scope is limited by both technological maturity and practical issues, all of which are yet to be resolved before it can ever be applied at scale (Vilkov, 2023).

New research has proved that the integration of blockchain into greenhouse gas monitoring, reporting, and verification (MRV) systems is feasible to provide safer and traceable emissions management spaces. Blockchain has the potential to mitigate the risk of double counting and fraud, as well as increase the efficiency of credit issuance and trade without necessarily affecting the risk of double counting or fraud in the design of credit issuance and trade (Vilkov, 2023). The developments are especially applicable in the

jurisdiction that seeks to modernize its carbon market infrastructure and its compliance with international standards.

Besides the blockchain, remote sensing technology is becoming a significant technology to enable the operations of carbon markets and monitoring of carbon confiscation. Such remote sensing techniques as satellite imaging, airborne monitoring, and sensor measurements are also becoming popular when it comes to monitoring land-use trends, reforestation, and soil carbon levels (Gudelè & Visockienė, 2023). Such technologies are essential in providing the right baselines and in making forest-based carbon credits credible (Cunningham & Montgomery, 2011). In addition to this, they allow developers of carbon projects and regulators to gather environmental information on a large scale and exchange it in a secure manner with blockchain-enabled systems without the involvement of any centralized intermediary (Pincheira et al., 2018). In combination, these technologies hold great potential as they can reinforce transparency and integrity in carbon markets.

2.14 Gaps in Knowledge

Carbon markets have gained more prominence in solving climate change, yet it become open to fraud and manipulation. Value-added tax fraud and emissions allowance thefts that have befallen the European Union Emissions Trading Scheme (EU ETS) have signified the weaknesses of registry cost-free and market jurisdiction (Weishaar, 2017). The Clean Development Mechanism (CDM) is more prone to having a fraudulent project additionality, especially since the project-by-project method of setting up additionality has given the CDM a loophole that can be exploited in the name of fraud (Drew, Jacqueline M., Drew, 2010).

The carbon value has shown its economic significance is increasing, and this has been accompanied by greater incidences of manipulation and misconduct in the carbon markets. Some academicians argue that these fraud-related practices may not only be rare but also occur in a systematic manner that has been entrenched in the world of carbon offsetting (Martin & Walters, 2013). However, although carbon disclosure research has experienced rising popularity. (Bazhair & Khatib, 2022) Note that the gap in knowledge regarding the assimilation of the carbon-related data into the overall corporate governance, auditing, and strategic financial planning is rather large, particularly in situations where institutional oversight is low.

Such mechanisms as the Clean Development Mechanism (CDM) have been instrumental in the transfer of low-carbon technologies to developing countries (Byamukama et al., 2022). These systems, however, do not waste away the possibility of being misused. The

necessity of showing additionality in CDM projects, a mechanism which is meant to show that reducing emissions is beyond the business-as-usual situation, has been chastised as being very subjective and can be manipulated, especially because it only exists at the project level and also due to verifiability complications (Drew, Jacqueline M., Drew, 2010). Similarly, various risk factors have been imminent in the EU Emission Trading Scheme (EU ETS), such as value-added tax (VAT) fraud and stolen emissions allowances, indicating substantial shortcomings in the registry protection and control measures (Weishaar, 2017).

Overall, all these examples indicate one and the same problem, namely, the monetization of carbon has been growing, which has turned these markets into an avenue for fraud attacks. This highlights the importance of having superior regulatory protections and constant monitoring to maintain the integrity and ecological soundness of market-based climate solutions.

CHAPTER III

METHODOLOGY

The research methodology used to conduct this research is presented in this chapter. It also shows details of the methodologies adapted, such as the choice of data source, the participants to be interviewed, as well as the reasons why Indonesia is chosen as the country for the main case study. In addition, the methods used to analyze and interpret the data are further discussed in the chapter, ensuring that the interpretation of the results of the research would imply both empirical statistical results and a contextual interpretation of the problem.

3.1 Research Design

Considering the objectives and exploratory nature of the study, a qualitative research methodology was used to provide rich context-specific information that is needed in answering the research questions. Qualitative approaches are especially indicated when the phenomena of a social and institutional nature are complex in nature, and they can use numerous strategies, including biography, ethnography, phenomenology, grounded theory, and case study (Elkatawneh, 2016). Such methods usually depend on such data collection instruments as interviews, document analysis, and observations (Merriam, 2002). Among these methods, the case study design is distinguished in such a manner that it applies to the proposed research on the basis of the ability of detailed investigation in a given setting.

In line with this, this study is going to use a qualitative case study in exploring the developing carbon market in Indonesia and the inherent issues that affect the carbon market when it comes to developing a reliable Emissions Trading System (ETS) and offset mechanism. This method enables us to have a subtle interpretation of regulatory, institutional, and technical processes that drive the progress of the market. An interpretivist epistemological position guides the study based on what different stakeholders think and can do with the developing climate policy and carbon trade systems.

In order to achieve the robustness and validity of the results, triangulation was applied as an essential methodological approach. Triangulation increases the credibility of the research by comparing multiple data sources, techniques, and theoretical orientations (Jick, 2016). Triangulation was implemented in three ways. These included data triangulation through interviews with government actors, industry, and international organizations representatives; methodological triangulation that uses both semi-structured interviews and document analysis; and theoretical triangulation by utilizing the concepts of the stakeholder theory and the theory

of institutional economics to conceptualize the results obtained through the prism of various lenses.

Triangulation was used on three levels: data sources, methods, and theoretical frameworks. Regarding data source triangulation, we have used a wide range of stakeholders in interviews, which were representatives of government agencies, the carbon project developers, international experts, and non-governmental organizations. Notably, this involved a direct interview of a representative of the European Union Emissions Trade System (EU ETS), which provides useful insights in the form of comparisons. The diversity of the stakeholder input enabled the study to attain a wider picture of the institutional problems and brought out both similar trends and different opinions.

The semi-structured interviews and document analysis were used to obtain methodological triangulation. People who have an active involvement in the carbon market and the policy making in Indonesia have been interviewed to give their first-hand views, whereas document analysis was conducted through reports published by the Government, papers written by scholars, and reports by multilateral agencies. They were used to cross-validate interview data and, therefore, increased the credibility of the entire analysis (Moeller et al., 2016).

Theoretical triangulation involved applying both stakeholder theory and institutional economics as interpretive lenses. Stakeholder theory enabled the exploration of how different actors each with distinct roles, interests, and levels of influence interact within the carbon market landscape. Meanwhile, institutional economics offered a framework for understanding how formal rules, transaction costs, and governance arrangements affects market performance and policy implementation. Triangulation not only improved the validity of this study's findings but also ensured that recommendations are grounded in both empirical realities and theoretical understanding.

In light of the above references to the various qualitative research approaches, the study draws lessons and guidance to inform the suitable research design for this thesis. The design has a cross-sectional appeal, including that the study doesn't examine all aspects of Indonesia's carbon market, as quantity data on emission reductions were not included. However, the design focuses on four main components, i.e., regulatory challenges, market inefficiencies, fraud risks, and MRV mechanisms, and lessons that can be drawn from the study to inform emerging carbon markets, particularly from developing countries. Developed interview questions for various stakeholders will focus on gathering insights on these four components to holistically identify challenges. Meanwhile, in review, the result will contribute

to the understanding of evolving challenges in carbon markets and to what extent the challenges have been addressed over time. Overall, the approach used in this thesis research includes three main steps: step (1) being the scoping; step (2), the coding of the data; and step (3), the analysis.

3.1.1 Scoping and Data Collection

Familiarizing oneself with the research phenomena is an important practice to help the author in qualitative data analysis. The benefits of getting familiar with the research topic will ensure that the author catches new insights or theories that surface during the data collection. This is why the research process involves careful design, data collection, analysis, and reporting, with an emphasis on validity, reliability, and ethics (Flick, 1998). (Flick, 1998) Also highlighted that qualitative data can be obtained through various methods, including interviews, focus groups, observations, and document analysis. The target stakeholders that the author engaged to interview in this research include the Indonesian policy regulator – OJK, international institutions, the carbon market (IDXCarbon Indonesia), practitioners, and academicians.

Data were collected through semi-structured interviews and document analysis. Six key stakeholders were interviewed from institutions such as MOEF, OJK, IDXCarbon, PLN, IETA, an EU ETS representative, and an academician. An interview guide covered themes like governance, MRV, market structure, and international alignment. Interviews were recorded, transcribed, and thematically coded. Documents reviewed included national policy papers, ASEAN frameworks, and EU carbon market reports to complement the interview findings.

The author utilized the use of a spreadsheet document to capture the first impressions and opinions of the participants and the document reviews. The spreadsheet also includes a column that highlights summary content and a short note of the author's impression of how the participant perceived the overall development of Indonesia's carbon market. The author then used these as a baseline that was referred back to as the research continued. Moreover, the author also deepens his understanding of the topic and identifies knowledge gaps with the help of summaries made from the interviews and the documents.

The author also conducted a case study to analyze the ETS and offset programs to identify the challenges, including the potential for fraud. The case study includes a domestic and international case to have a holistic understanding from the perspective of both instances. Hence, the case study research process typically involves designing the study, selecting a

sample, and addressing validity, reliability, and ethical concerns (Merriam, 2002). Importantly, the relationship between theory, method, and fieldwork in qualitative research is complex and iterative, with each element informing and influencing the others (Lobo, 2020).

The methods used for data collection in this study involve studies from reports, academic articles, public records, and semi-structured interviews with stakeholders. These approaches are guided by theoretical frameworks such as interactionism, phenomenology, and critical theory, which inform research questions, data collection, and interpretation (Reeves et al., 2008). (Roulston & Halpin, 2022) identifies five main traditions in qualitative inquiry: biography, phenomenology, grounded theory, ethnography, and case study, each with distinct characteristics and applications.

3.1.2 Data Collection Methods

To ensure the effectiveness of the research design, it was essential to identify the specific types of data needed and determine the most suitable methods for obtaining them. Given the qualitative nature of this study, the research primarily relied on qualitative data to explore the nuanced dynamics of Indonesia's carbon market. Accordingly, primary data were collected through two main channels: semi-structured interviews with key stakeholders and the review of publicly available academic publications, policy reports, and institutional documents. This combination of sources allowed for a rich and contextualized analysis aligned with the study's objectives. Due to limitations in accessing direct participants from all the intended stakeholders, the study relied on in-depth document analysis of several documents from authoritative sources, and these documents include studies from both global and domestic contexts.

Eight in-depth interviews were conducted with individuals from key institutions involved in Indonesia's carbon market development. Respondents were selected based on their professional roles and technical knowledge. The interviews were designed to capture insights from the policy, operational, and implementation levels. An interview guide was developed based on the research objectives and structured around key thematic areas such as institutional design, market functioning, MRV infrastructure, legal frameworks, fraud prevention, and international integration. Interviews were conducted in English or Bahasa Indonesia, depending on the participant's preference, and all interviews were transcribed for thematic analysis.

Before going deeper into the challenges in Indonesia's emerging carbon markets, the author created an Excel spreadsheet of all the key parties involved in Indonesia's carbon

trading process. This document included information about the respective parties' organization name, the representative for the interview, and their roles to help establish relevance to the research. The author further uses this information from the spreadsheet to classify the parties into six stakeholder groups, i.e., International Institutions, Academicians, Practitioners, Regulators, Government Agencies, and Market Participants. Informed by the main research question, "*What are the key challenges facing Indonesia's carbon market, and what lessons can be learned for emerging ETS and offset markets?*"

3.1.3 Coding of the Data

According to (Braun & Clarke, 2006), codes are described as pithy labels that identify what is of interest to us in the data, and as for themes, these are a common or recurring pattern across datasets and, therefore, clustered around a central organizing concept. This research uses Data analysis techniques that include coding and thematic analysis. While qualitative research has faced criticism for lacking rigor, it provides valuable insights into human elements and interpretations of meaning (Birchall, 2014; Given, 2012). (Flick, 1998) further added that analysis techniques range from coding and thematic analysis to discourse analysis and hermeneutics. The quality of qualitative research is assessed through specific criteria, and the findings are typically presented in narrative form (Flick, 1998; Merriam, 2002).

In order to interpret the data of the interviews, the author has used the method of thematic analysis. This method was selected because it was able to identify, interpret, and report patterns in the qualitative research data in a systematic manner, which fit well with the exploratory nature of the data in the study. When developing the semi-structured interviews, the author took a process-structured approach in five phases suggested by (Kallio et al., 2016) and with the steps of identifying the prerequisites, literature survey, building the interview guide, pilot testing, and instrument finalization. Such a formal pattern made the interview very credible and consistent. This was also done in terms of different conceptual models, which were considered in the design of the interviews, including biographical and narrative techniques, as (Wengraf, 2011) suggested. The interviews ought to capture policy as well as the experience.

The researcher reconnoitered every detail of the interview, including the first contact with participants, as well as after the interview. Data organization and coding were conducted using both spreadsheets and Quirkos qualitative analysis software, facilitating the development of themes closely aligned with the research objectives. These themes were structured around the study's four core areas i.e., regulatory frameworks, market

inefficiencies, fraud risks, and lessons for emerging markets, providing a clear and coherent presentation of the findings.

Thematic analysis with reference to (Braun & Clarke, 2006) was used to analyze the transcribed data. The author applied emergent and theory-informed strategies to code the data using the Quirkos application. And also examine the transcripts numerous times to identify patterns, then triangulate with findings gathered from the document analysis. Additionally, a subset of the codes was reviewed to strengthen reliability.

3.1.4 Document Analysis

In parallel, the study reviewed and coded over ten institutional and academic documents, including presentations and policy briefs from Indonesian institutions (MOEF, IDXCarbon, OJK), International publications from INTERPO, ASEAN Green Finance Landscape, and also academic articles related to EU ETS performance, fraud cases, and regulatory design. These documents provided essential background and policy context and served as a comparative basis for evaluating Indonesia's progress and identifying implementation gaps. Findings from document analysis were coded and triangulated with the interview data to strengthen analytical depth.

This approach enabled strong triangulation of the primary data and well-documented secondary analysis from the EU ETS and ASEAN carbon finance context. Some of these documents include publications and reports that offer in-depth policy-based insights into the evolution of the EU ETS's regulatory, institutional, and operational experiences. The documents are also carefully selected, thus ensuring their credibility and relevance. Hence, they are authoritative sources written by experts and researchers who have studied and been involved with the EU ETS and Indonesia's carbon market landscape. The references that are used in the analysis of these documents are usually official EU and Indonesian data, public investigations, and market records, making them reliable and relevant. See Table 3.2 below for a list of documents used in the analysis and findings of this study.

Table 3.2 List of documents used in the analysis and findings

Document Title	Source / Author	Year of Publication
Emissions Trading in Practice, Second Edition: A Handbook on Design and Implementation	World Bank	2021
Fraud on the EU Emission Trading Scheme – Effects, Vulnerabilities, and Regulatory Reform	Katherine Nield & Ricardo Pereira	2011
Financial crimes in the European carbon markets	Stefan E Weishaar	2017
Indonesian Carbon Trade Ecosystem Development	MoEF	2025
Accelerating Net Zero and Unlocking Indonesia's Carbon Market Potential through IDXCcarbon	IDXCcarbon	2025
Green Finance Landscape in ASEAN: Trends, Challenges, and Opportunities	CSIS Indonesia, GIP, ASEAN Chapter & Tenggara	2025
Scientific advice for amending the European Climate Law: Setting Climate Goals to Strengthen EU strategic priorities	Strategics European Scientific Advisory Board	2025

3.1.5 Semi-Structured Interviews

As applied in this study, Interviews, a common data collection method, require careful consideration of ethical principles and methodological approaches to achieve desired research outcomes (Lobo, 2020). Overall, qualitative research emphasizes practical applications while maintaining a strong theoretical foundation (Merriam, 2002). Qualitative research encompasses various methodologies, including case studies, interviews, and document analysis (Merriam, 2002).

To obtain the primary data required for this thesis, the author conducted ten interviews with participants from six relevant stakeholder groups. These interviews aimed to enable the author to have valuable in-depth insights into the key challenges facing Indonesia's carbon market, and what lessons can be learned for emerging ETS and offset markets. Although several challenges are highlighted throughout the document reviews, interviews are still necessary, and semi-structured interviews are a powerful qualitative research method that

allows researchers to obtain in-depth information while maintaining flexibility (Mashuri et al., 2022; Peters & Halcomb, 2015). The author used this approach because it enabled the author to adapt their questions during the interview process, providing insights into participants' experiences and perceptions (Peters & Halcomb, 2015). See Table 3.3 for the list of interview participants. Also allowing for flexibility to ask additional questions that come up during the interviews, which may not have been intended beforehand.

Table 3.3 List of Interview Participants

Stakeholder Group	Institution	Participant's Role
International Institutions	International Emissions Trading Association IETA	International Policy Analyst
Government (Indonesia)	Ministry of Environment and Forestry (MoEF)	Directorate of Carbon Pricing Governance, Deputy of Climate Change and Carbon Governance
Government (EU)	European Commission in the Department for Climate Action	Task force on carbon pricing and carbon markets diplomacy
Practitioners	Perusahaan Listrik Negara PLN	Officer Business Development Innovative Solution, under Corporate Business Development & Investment Division
Market Participant	IDXCarbon	Officer Carbon Trading and New Initiatives Unit
Academicians	Co-hosted by the SDGS sector at Universitas Padjadjaran & Landscape Indonesia	As international Fulbright program researcher of Indonesia's carbon cap and trade program

CHAPTER IV

FINDINGS AND ANALYSIS (DOCUMENT ANALYSIS APPROACH)

This chapter presents the core findings of the study, synthesizing evidence from document analysis and stakeholder interviews. The discussion is framed around the research objectives and triangulated using multiple data sources and perspectives. The aim is to provide a structured analysis of the institutional, technical, and policy challenges facing Indonesia's carbon market, while drawing comparative insights from more mature systems like the EU ETS. This chapter directly addresses the three research questions posed in Chapter I, including (1) What are the key challenges facing Indonesia's carbon market?; (2) What lessons can be learned from international carbon markets such as the EU ETS? (3) How can Indonesia strengthen its carbon market to ensure credibility, efficiency, and global alignment? (4) The following sections present findings categorized thematically, based on both document and interview data.

4.1 Overview of the Carbon Market in Indonesia

Indonesia's carbon market is in a transitional phase, characterized by the coexistence of a voluntary market, which is used primarily by corporate actors, and an emerging mandatory market driven by government regulation. The market infrastructure includes IDXCarbon as the trading platform, SRN-PPI as the national registry system, and MRV protocols under MOEF and OJK supervision. However, interviewees and official documents revealed that the legal framework remains fragmented and enforcement capacity underdeveloped.

4.1.1 Primary vs. Secondary Markets

In Indonesia, the primary carbon market refers to the direct issuance and sale of carbon credits by project developers to buyers, often through agreements with brokers or in initial auctions. This is where most activity currently occurs, especially in the forestry and renewable sectors. Whereas the secondary market, is where these credits are resold or traded among third parties such as brokers or investment funds, remains limited due to low liquidity and unclear regulatory guidelines. IDXCarbon supports both types of transactions, but interviewees noted that secondary trading is still developing due to price uncertainty and a lack of participants.

This distinction is crucial for market development, as a vibrant secondary market typically enhances price discovery, market liquidity, and investment confidence, all of which are currently weak in Indonesia.

4.1.2 Voluntary vs. Mandatory Carbon Markets

The voluntary market in Indonesia has been active since before the formal launch of the national exchange, with companies purchasing credits to meet internal ESG or CSR goals. These credits are often verified through international standards such as Verra and Gold Standard. In contrast, the mandatory, also known as the compliance market, guided by Presidential Regulation No. 98/2021 and the pending carbon tax, is still in early implementation. It currently targets a narrow band of regulated entities, such as the coal-fired power plants, but is expected to expand over time.

Analysis from the documents and interviewees from MOEF and IDXCarbon highlighted the policy gap between these two markets. Without proper integration mechanisms, such as mutual recognition, clear sectoral roadmaps, and thresholds, voluntary credits may be excluded from future compliance schemes, creating uncertainty for project developers.

4.1.3 Key Thematic Findings

- a. **Institutional Fragmentation and Governance Gaps:** Both documents and interview data reveal overlapping responsibilities between MOEF, OJK, and other agencies. This results in inconsistent messaging, duplication in registry requirements, and slow decision-making. Stakeholders called for a central carbon market authority or a stronger interagency task force.
- b. **Weak MRV Systems and Registry Integrity:** The SRN-PPI registry and MRV protocols are still evolving. Interviews with project developers and verifiers revealed long lead times, unclear guidance, and insufficient training. Without robust MRV, the environmental integrity of credits is at risk.
- c. **Technology and Infrastructure Challenges:** Though IDXCarbon offers an electronic trading platform, many participants expressed concerns over price transparency, low trading volumes, and user interface limitations. Blockchain has been suggested as a future solution for tracking credit provenance, but it is not yet in use.
- d. **Legal and Pricing Uncertainty:** The absence of finalized carbon tax legislation weakens demand in the compliance market. Credit prices on IDXCarbon range from IDR 30,000 to 70,000 per ton CO₂e, which is significantly below international levels. Without strong price signals, there's limited incentive for mitigation.
- e. **Fraud Risks and Oversight Gaps:** Drawing from EU ETS lessons, interviewees warned of potential fraud in the form of duplicate credit issuance, credit theft, or project misreporting.

Indonesia's registry and trading systems are not yet integrated into AML/CFT frameworks, increasing vulnerability.

- f. International Linkages and Recognition: Indonesia's voluntary credits are not fully recognized under global Article 6 mechanisms. Interviews with EU and IETA stakeholders emphasized the need for mutual recognition agreements, corresponding adjustments, and alignment with international standards.

In summary, Indonesia's carbon market shows strong early potential but is constrained by governance fragmentation, technical infrastructure gaps, and limited legal certainty. The insights from document analysis and stakeholder interviews converge around the need for coordinated reform, improved MRV systems, and greater international alignment. These issues are addressed further in Chapter V through targeted policy recommendations.

4.2 Detailed Summary of the Analyzed Documents

This article by Ellerman, Convery, and de Perthuis (World Bank, 2021) examines in full the European Union Emissions Trading Scheme (EU ETS), the first and biggest cap-and-trade system for emissions in the world. It looks at Phases I and II of the EU ETS (2005–2012), exploring essential issues such as how allowances are distributed, market behavior, price creation, emission reductions, and political economy factors. It also reviews some of the early implementation challenges, valuable lessons, and shifts in market governance on the EU stage. It aims to provide readers with an in-depth understanding of the scheme's implementation, effects, and the broader implications of capping, trading, and pricing emissions.

In the paper authored by (Nield & Pereira, 2011), the authors address the increasing appeal of the European Union Emissions Trading Scheme (EU ETS) to fraudulent activities because it has grown in magnitude as well as value. The article investigates the reasons why there were regulatory gaps that facilitated the occurrence of tax fraud, carbon credits theft, and unsuitable trading activities. It points out forces of great concern with regard to the EU ETS market, which include value-added tax (VAT) fraud. The paper examines the effect of such frauds, how weaknesses in the regulation of registries, which act as a bank of emissions allowances, can be exploited, and the efficiency of recent regulatory proposals made by the European Commission. Besides, it exposes the fear of the stakeholders in relation to the targeted changes and the possible insufficiency of the proposed reforms to deal with the hazards of fraud in the system.

His work (Weishaar, 2017) examines the aspect of financial crime in the European Union Emissions Trading Scheme (EU ETS). It is like financial crime through the lens of law

and economics, and it focuses on the explanations of how such fraud became possible. Some of the numerous carbon crimes mentioned and discussed in the document include VAT carousel, phishing, identity fraud, and carbon credit fraud. The paper discusses the issues of legal inconsistency among member states and suggests ways to encourage and promote integrity and compliance. It also talked about the issues of implementation and market manipulation, and enforcement. It is a resource that can provide a good overview of the climate laws and the nature of financial crimes in carbon markets, with the voices of a number of scholars and legal experts skilled and experienced in this area.

This report, presented by the MoEF (MoEF, 2025), was presented at the Workshop on Strengthening Safeguards Against Carbon Crimes in Indonesia. Carbon Pricing Implementation through its PPPI LH department. The author was a participant at this event, and the presentation details how Indonesia's national carbon market was set up and functions. It introduces the legal environment, covers required policies, outlines various kinds of carbon certificates, and explores what the carbon pricing system can do. Building a powerful Measurement, Reporting, and Verification (MRV) system and fitting domestic rules with UN requirements, especially Article 6 of the Paris Agreement, gets top priority, as stated in the document.

The document also highlighted that Indonesia has set ambitious targets, including achieving FOLU Net Sink by 2030 and aiming for Net Zero Emissions (NZE) by 2060 or sooner. It emphasizes the significance of Presidential Decree 98/2021, which facilitates the establishment of a compliance market for carbon trading in Indonesia. The documents also mention milestones and developments in both voluntary and compliance markets, highlighting the strategic role Indonesia plays in global climate action.

As for the document from IDXCarbon, the author was invited for a visit to IDXCarbon during which the author attended a presentation titled "Accelerating Net Zero & Unlocking Indonesia Carbon Market Potential Through IDXCarbon" (IDXCarbon, 2025). The presentation maps out how Indonesia's first carbon exchange is structured, and it describes its trading rules and how it is managed. IDXCarbon came under the umbrella of the Indonesia Stock Exchange (IDX) to assist in regulated and transparent carbon trading enabled in Presidential Regulation No. 98 of 2021 and OJK (Financial Services Authority) rulings. It describes the way the system facilitates auctions and negotiations during the trading process, describes registration of credits, and enumerates the obligations of participants.

It also talks about the significance of carbon trading in Indonesia as a means of achieving national goals of reducing carbon emissions in green comments. It focuses on what

Indonesia has pledged in the Paris Agreement and how it has laid out the Enhanced Nationally Determined Contributions (NDC) plan that the country intends to follow in the year 2030. Here, the report identifies a number of sectors and their respective objectives, how the objectives are to be achieved, and how carbon trading can help companies. It also provides an overview of the effect of greenhouse gases on global warming and the relevance of carbon exchange in the carbon trading processes.

Green Finance Landscape in ASEAN: Trends, Challenges and Opportunities, a report provided by CSIS, GIP, and Tenggara Strategies (Damuri et al., 2025), covers in great detail the development of sustainable finance in Southeast Asia. Carbon markets, green bonds, multilateral projects, and the current policy methods. The report describes the case of Indonesia within the background of the ASEAN countries, with the focus on assets, issues, and potential opportunities of carbon finance on the one hand, and regulating consistency on the other hand.

It also addresses other topics, including regional circumstances and dynamics, policy and regulation, governance, and financial instruments when it comes to green finance. The report highlights the need that green finance initiatives, the problems that the region is experiencing, and the growth opportunities. Among the main points are the ASEAN Taxonomy, the ASEAN Green Bond Standard, and other types of financial instruments such as transition finance, blended finance, green bonds, and carbon markets.

The policy brief that was published by ESABCC (ESABCC, 2025) provided valuable ideas and suggestions to enhance the European Climate Law on the basis of expectations of the EU in 2040. The plan suggests, 90-95 percent reduction of emissions of greenhouse gases to their levels from 1990 by the year 2040 and says that it must be equitable and reliable, and interlinking of different sectors must be retained. It puts together scientific modeling, the evaluation of different sectors, and consultations with the stakeholders to ensure that the EU adheres to the ambitions of the Paris Agreement in the coming years. It notes that there is a need to reinforce the EU climate plans in view of security, economic, and energy challenges, and notes the need to establish sound, science-based climate goals in the year 2040. Moreover, it covers how the EU is adapting and becoming resilient to the increasing climate risks, how there is an intense policy gap, and how the present policy can be improved.

4.2.1 Key Findings from Document Analysis

From the analysis the author conducted (World Bank, 2021), it was revealed that Cap-Setting and Over-Allocation were some of the major challenges during Phase I, which

occurred due to too many allocations of allowances, thus lowering the carbon prices. Hence, reducing the incentives and making it less attractive to reduce emissions. This was then rectified during Phase II when countries were given trimmer emissions caps based on accurate data of their emissions. Allowance Allocation and Political Influence was also a challenge in the initial phases, allowance allocation was largely given away for free, and was determined by political negotiations. For this reason, member states faced challenges such as price distortions and fair competition across member states.

The analysis further revealed the Market Behavior and Learning Curve, showing that although the ETS faced some challenges with prices at the start, the ETS established a working carbon price, showed how to use a market-based approach across countries, and prepared the way for better practices going forward. Moreover, (World Bank, 2021) further underscored Institutional Learning, wherein the EU ETS demonstrated why having multiple improvements in regulations is so important. Between the first and second phases, MRV systems, registries, and compliance procedures improved, which reduced administrative and verification flows. Sectoral and Geographic Scope was also highlighted, stating that the ETS was introduced to the energy and industrial sectors, but not to those in transport and agriculture at first. The knowledge gained from the scope definition was used to guide future global market development.

The analysis drawn from the study of (Nield & Pereira, 2011), VAT Carousel Fraud was highlighted. The document presented a brief history of attempts to defraud the EU ETS, which began in 2008 and resulted in an estimated loss of more than €5 billion between 2008 and 2009. Put simply, the way the trading system was set up made it easy for criminals to take advantage of zero-rated VAT. It also provided evidence of Carbon Credit Theft and Registry Breaches. It stated that Poor controls over national registries made it possible for hackers to steal and use someone else's carbon credits. The findings revealed that online account controls, financial transaction security, and data tracking were not optimal.

Analysis from (Nield & Pereira, 2011) shows that Regulatory and Legal Gaps were due to the lack of a harmonized regulatory response across EU member states, and the absence of strong criminal sanctions across EU nations resulted in delayed prosecution of crime. Market Impact was also identified, thus underscoring that the exposure to fraud led to a momentary drop in people's trust in ETS. This, therefore, temporarily impacted market volatility and damaged the reputation of the scheme, mostly in Phase II of the EU ETS scheme. It furthermore revealed the use of Reform Measures, which, in response, the European

Commission put laws in place, such as a shift to centralized registries, i.e., the Union Registry for carbon credits. Hence, improved security, stopped spot trading when needed, and integrated carbon credit trading with an anti-money laundering framework in the EU.

Analyzing the study (Weishaar, 2017), which looked at financial crimes in the European Union Emissions Trading Scheme (EU ETS), presented Typologies of Carbon Crimes. The paper classifies major types of carbon crimes, specific ones being allowance theft, phishing, registry manipulation, and identity fraud. It reflects how smart the people behind this scheme are, as more carbon trading is done on the internet. It also highlighted the effect of Legal Fragmentation, stating that major weaknesses in the EU ETS resulted from different regulations in each EU nation. Because the regulations were not applied the same in each country, the results were weak enforcement and little prevention.

The analysis further captured that Slow Regulatory Response contributed to more issues. Because of the slow response from authorities and laws, challenges related to fraud were not resolved promptly when signals were already there. Due to this, carbon crimes became common and damaged the ETS's reputation. The paper notes that before the EU ETS was regulated, Systemic Risk and Market Confidence were there; hence, the market contained serious systemic faults that exposed it to both legal and financial risks. Therefore, the Call for Harmonization and Proactive Oversight was prompted. This proposes that all EU member states join in developing one criminal regulatory framework for carbon markets and integrate their carbon market regulation with wider financial architecture.

The analysis from the report by the MoEF (MoEF, 2025) shows the significance of the Nationally Determined Contribution (NDC) Alignment since the carbon market is seen as a way to reach Indonesia's national commitments. To achieve this national target, emissions traded inside the country must be truly additional, easy to measure, and fully verifiable. The Dual Market Pathways approach in Indonesia was also highlighted, stating that two markets operate. One is for public compliance under Presidential Regulation No. 98 of 2021, and the other is a separate market for private parties who wish to buy and sell verified carbon units. However, the Mutual Recognition Agreement (MRA) is being used to bring together these distinct trade approaches into one system.

Analysis of the (MoEF, 2025) report further shows the Types of Carbon Units recognized in Indonesia. It noted that the system identifies Greenhouse Gas Emission Reduction Certificates (SPE-GRNK) and Carbon Offset Certificates (SPE-PU) as separate units of carbon. However, both types have to be registered in the SRN-PPI national registry.

The Market Infrastructure Development was also highlighted, wherein it outlines plans for creating and using auctions, trading platforms, and integrating registries via IDXCCarbon. It stated that since early 2025, they have started operating on a small scale with a restricted number of participants. Furthermore, the Challenges were also identified, and the main issues identified include weak interagency coordination, insufficient verifiers, unclear guidance for Article 6 compliance, and most people do not fully understand carbon trading.

The analysis we draw from (IDXCCarbon, 2025) indicates Indonesia's Exchange Mechanisms. It was learned that you can use IDXCCarbon to trade using negotiated trading, regular auctions, and spot transactions. However, so far in Q1 2025, trades are mostly done on negotiated platforms as the market remains relatively low in liquidity. Participant Structure was also discovered, showing that as of early 2025, the platform recorded 107 participants, among these were regulated entities following national carbon tax rules, project developers, and those who purchased carbon credits on a voluntary basis.

Among other key elements, Credit Types and Eligibility were also highlighted. The analysis shows that only registered and national MRV-compliant credits in SRN-PPI are allowed to be traded. Which consists of both SPE-GRK and SPE-PU units. Moreover, it was discovered that Price Signals and Transparency are observed. Hence, IDXCCarbon posts daily carbon price indicators while pointing out that, at the moment, the volumes of trading do not support true price observation. Prices early in the year ranged between IDR 30,000 to 70,000 per ton CO₂e, much lower than international average prices. With regard to Regulatory Oversight, OJK and MoEF are responsible for supervising IDXCCarbon operations, with internal compliance systems in place to stop attempts at market manipulation. However, policies for enforcing these protocols are not yet in place.

Findings from the analysis of the recent research report on Green Finance Landscape in ASEAN: Trends, Challenges, and Opportunities from CSIS–GIP–Tenggara Strategies (Damuri et al., 2025) show Fragmentation of Standards. This is because green finance is not required by any enforceable laws, and the ASEAN green finance ecosystem is hampered by voluntary coordination. As a result, it becomes hard for local markets to connect and enable investors to trust the area. Another key finding was Indonesia's Position, which underscores that even though Indonesia is a leading country in nature-based carbon credits. Therefore, it is currently ranked lower than Malaysia and Singapore in standardization, registry management, and legal frameworks regarding carbon trading.

Low Carbon Prices were also a key aspect that was identified in the analysis, highlighting that carbon credit prices in Indonesia are still the lowest in Southeast Asia. This

is mostly because of regulatory ambiguity, few people trading the credits, and a lack of quality differences between credits. It was subsequently found that the lack of Multilateral Platforms is another factor that hinders the progress of Indonesia's carbon market. However, the ASIAN Catalytic Green Finance Facility (ACGF) and the ASEAN Taxonomy are playing a major role in bringing together the region's financial environment, including investment mobilization. The country's involvement in these mechanisms is ongoing but not consistent. The analysis further shows issues related to the Just Energy Transition Partnership. Pointing out that the JETP of Indonesia, known as a flagship program, with mixed outcomes, faces challenges due to authority bottlenecks, SOEs being active in the coal industry, and regulatory reforms.

The ESABCC's (ESABCC, 2025) policy brief was the last document that was analyzed for this study. This policy report issued useful insights and recommendations to improve the European Climate Law based on the EU's ambitions for 2040. Analysis shows an Ambitious 2040 Target, which was proposed by the ESABCC, indicating that a 90–95% cut in greenhouse gas emissions will be achieved by 2040. It highlights how early and strong action is important in the energy, transport, agriculture, and industry sectors.

Integration of Carbon Removals was highlighted as a means to remove carbon from land and technology. But the advisory board stated that both ways must be covered by the EU's rules, as long as this does not reduce the need to cut emissions.

Policy Coherence and Equity were also a part of the findings, which emphasize the importance of making sure that climate change actions are distributed fairly for all member states and with respect to their capabilities and duties, as well as social justice. It further presents issues related to Legal Certainty and transparency, underscoring that making predictable and enforceable climate law will allow for more investment and a secure structure for emissions trading. Science-based governance was recommended by the board, implying that EU climate actions should be based on evidence-based mechanisms and should be updated as needed to keep up with new conditions according to data and socio-economic needs.

4.3 Analysis of Interviews for Triangulation and Synthesis with Document Analysis

A synthesis of the themes identified in the interview with the document analysis demonstrates the convergence of the issues and, therefore, confirms the robustness of the findings. The cross-cutting areas developed were found to be the key determining factors in the success of Indonesia's carbon market. As illustrated in Table 4.4 below, it summarizes key themes shared across multiple data sources, helping validate the relevance of observed patterns and highlighting the most pressing areas for policy and technical reform in Indonesia.

Table 4.4 List of Themes and Sub-Themes

Themes	Sub-Themes Themes Identified From Interviews and Documents	Key Sources
Regulatory Architecture	Fragmentation of mandates, lack of coordinating authority	Katherine Nield & Ricardo Pereira, CSIS, GIP, ASEAN & Tenggara Strategics, MoEF, IDXCarbon, Interviews with Academician, EU
Market Liquidity & Participation	Low number of buyers/sellers, restricted access, and voluntary market dominance.	World Bank, CSIS, GIP, ASEAN & Tenggara Strategics, IDXCarbon, Interviews with PLN
MRV and Technical Infrastructure	Slow MRV processes, unclear procedures, verifier shortages	MoEF, CSIS, GIP, ASEAN & Tenggara Strategics, Interviews with PLN, Academician
Carbon Pricing and Valuation	Absence of meaningful price signals, undervalued credits	World Bank, Interviews with IDXCarbon
Fraud and Market Integrity	Risks from insufficient oversight, low transparency, and a lack of registry security	Katherine Nield & Ricardo Pereira, Stefan E Weishaar, Interviews with IETA, EU
International Recognition & Linkages	Limited acceptance of Indonesian credits abroad requires MRAs	CSIS, GIP, ASEAN & Tenggara Strategics, ESABCC, Interviews with IETA, EU
Legal Clarity and Enforcement	Ambiguous rules, slow progress on the carbon tax, and enforcement mechanisms	MoEF, ESABCC, Interviews with IDXCarbon, PLN
Capacity Building and Institutional Readiness	Gaps in verifier training, registry governance, and agency coordination	MoEF, IDXCarbon, Interviews with all stakeholders

Strategic Position and Opportunity	Strong nature-based credit potential, ASEAN leadership opportunity	CSIS, GIP, ASEAN & Tenggara Strategies, ESABCC, Interviews with IDXCcarbon, PLN, Academician
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Based on the interviews conducted with major stakeholders such as IDXCcarbon, Perusahaan Listrik Negara PLN, International Emissions Trading Association IETA, and an academic expert. Table 4 above contains several consistent themes that were identified that support the findings derived from the document analysis. Among these are Regulatory fragmentation and a lack of central coordination. This was an issue of concern among the participants in view of the fragmentation of the regulation of the carbon market in Indonesia. There are several ministries (MOEF, MEMR, OJK, Ministry of Finance) functioning with different mandates, having no centralized coordinating body, thus resulting in inconsistency and confusion in the regulatory matters.

According to the academic respondent, it is difficult to know who exactly is responsible for what. The IETA participant also pointed out the importance of having a centralized governance model to demarcate roles among institutions.

Respondents highlighted that the lack of a carbon tax and weak mandatory market design is another challenge that exists in Indonesia's developing market. Despite the existence of the regulatory mechanism, the introduction of the mechanism of carbon tax is late, which weakens the promotion in the mandatory market. The participants from PLN and IDXCcarbon cited carbon tax as one of the significant enablers that may drive the demand and communication of seriousness in the market. Without it, the obligatory market will be narrowed down largely to coal-powered plants, which, as a result, is the current effect that is limiting both the scope and liquidity.

In addition, it was discovered that due to MRV Bottlenecks and Inefficiencies, stakeholders have been concerned with the excessive amounts of bureaucracy in the process of registering projects and MRV (Monitoring, Reporting, and Verification), which slows down project activation and delays participation. According to an academic expert, the MRV process may require more than a year, and, therefore, it is not practical for developers of small or new projects. Furthermore, the participant from PLN stresses the urgent need to enhance traceability and auditability, desirably through the existing blockchain systems.

Issues of price transparency and market access were explained by the participants from IDXCarbon and also reflected in the document analysis. It is discovered that the existing pricing system relies mainly on the nature of the project, and there is no common pricing standard or a means of pricing discovery. Prices lie within the range of USD 4-9 per ton CO₂e, which is much lower than the international standards. Moreover, only legal corporations enjoy access; meanwhile, there could be potential individuals who might have an interest in participating in the carbon market but are indirectly prevented from joining it at the moment.

Another major challenge discovered from both the document analysis and the interviews with the stakeholders in the current state of Indonesia's carbon market is the international integration and recognition gaps. Mutual recognition agreements (MRAs) were identified by the stakeholders as the vital means of facilitating international trade and the credibility of Indonesian credits. All the stakeholders that participated in the interviews unanimously agreed on this; however, they have all cited that there has been progress on agreements with Gold Standard and VERRA. Although the domestic SRN-based credits which is currently in use is still not recognized beyond Indonesia. The participant from IETA further noted that with full international recognition, Indonesia's carbon market will be able to attract more investments.

There were wide discussions of capacity constraints that evolved around Indonesia's institutional planning and capacity gaps, particularly regarding the training of verifiers and developers of registries, as well as inter-ministerial technical readiness. IDXCarbon and PLN participants highlighted that although the market architecture is functional, its size is constrained by inadequate sectoral roadmaps to onboard and support scaling the market for more impact. Several respondents proposed that Indonesia can use the experience gained in Korea and in the EU, especially scaling systems and the development of centralized capacity.

Aside from challenges, the stakeholders remain optimistic about the future of Indonesia's carbon market. There is consensus among the participants that Indonesia has a lot of potential because it has a huge natural-based offset project potential from the forests and peatlands. The country could also gain a lot from the future CORSIA aviation offset needs for 2027, and they have the early mover advantage in the Southeast Asia region. All of these present opportunities that require strategic leverage for the market to succeed in spite of the challenges. These opportunities, however, might only be fully utilized if the state can harmonize the regulation, implement carbon taxes, and enhance MRV and market infrastructure.

4.4 Lessons Learned for Emerging ETS and Offset Markets

Together, the document analysis and the interviews indicate several strategic lessons that not only Indonesia but also other new emissions trading schemes (ETS) and offset markets could learn. Just like the developed markets did, we have learned that it is important to start with simplicity and scale with precision. Lessons from the study have shown that overcomplication at an early stage in regulations or MRV systems can hamper participant attraction, which actively discourages people from participating. Simpler initial frameworks, with clear direction, piloted, and phased in are reliable foundations that can ensure market growth.

The coherence between institutions is a key aspect that must be ensured for any market to be effectively functional. We have learned from both the document analysis and interviews that there must be a single national carbon market authority, or a powerful inter-ministerial coordination task force, to avoid fragmentation issues and streamline regulatory operations. As for the designing of MRV and registry systems, the study has taught us that these should be designed to be secure and reliable. Because if the registry and MRV frameworks are not secure and efficient, it will be difficult to establish market trust. Therefore, it is essential to invest in a strong digital infrastructure, traceability in real-time traceability, and certification verifiers.

For an emerging market, Investor confidence is essential for growth, and investment is attracted by legal certainty. Slow progress towards the implementation of carbon taxes or the release of detailed guidance can result in reducing the confidence of investors. Carbon markets perform well when there is clarity, consistency, and enforceable rules. Another important lesson learned is that carbon pricing has to incorporate environmental value, and also make sure that carbon pricing reflects environmental value. Evidence has shown that false carbon prices in the form of tokens or artificially low prices do not contribute to real mitigation.

It is also important to note that the use of auction-based allocation, transparent price schemes, and market-driven adjustment of caps are essential to effectiveness. Moreover, market legitimacy is determined by the offset integrity, and depending heavily on poorly verified or globally unrecognized offsets exposes a threat of greenwashing. Emerging markets should establish rigorous standards for issuing credit and enforce corresponding adjustments.

We have learned that in instances where compliance and voluntary markets are to be blended, this should be done carefully. It should be realized that a voluntary market is optimal in ensuring force, but when there is uncertainty of high separation or integration in compliance

systems, this may cause confusion in markets and regulatory problems. Likewise, new economies are advised to utilize foreign alliances to create capacity. International partnership with globally recognized mechanisms like the Gold Standard, VERRA, and ACGF can help in the training of verifiers, MRV, and recognition of the credit. This can be of great assistance to the jurisdictions that usually lack the capacity, especially those with less capability. Lastly, the climate policy must be pitched as a means of enhancing carbon markets as an economic policy. The popularity of carbon markets can be boosted through policies that are connected to energy security, competitiveness, resilience, and through parameters that take into consideration the factors of emissions.

Such lessons are especially relevant today due to the fact that more developing nations are coming to terms with the thought of market-based climate tools. Indonesians' experience can be an example, or rather a warning, depending on which solution will be implemented using these lessons.

CHAPTER V

CONCLUSION

5.1 Conclusion

This paper sought to analyze the issues surrounding the design of a viable and trustworthy carbon market in Indonesia and to extract some lessons that may be learnt from more established systems, such as the EU ETS and the ASEAN systems. By using a triangulated qualitative approach, combining document analysis, stakeholder interviews, and theoretical framing the research has generated a nuanced understanding of the institutional, regulatory, and technical dimensions shaping Indonesia's carbon market.

The findings show that Indonesia's carbon market remains in an early and transitional phase, with a coexistence of voluntary and compliance frameworks, yet lacks the coherence and capacity needed for full-scale implementation. The market is constrained by:

- a. Fragmented institutional mandates and overlapping authority (MOEF, OJK, IDXCarbon),
- b. Weak MRV and registry systems that hinder verification and trust,
- c. Legal and pricing uncertainty, especially around the carbon tax and trading guidelines,
- d. Limited participation in both primary and secondary markets, especially among private actors,
- e. Inadequate technological infrastructure to support transparent and scalable trading,
- f. Gaps in international recognition, with credits not yet fully aligned to Article 6 requirements.

The research also found that stakeholder interests often diverge. Regulators prioritize control and environmental sovereignty; project developers seek clarity and predictability; and international actors focus on integrity and harmonization. This tension reflects a deeper challenge of aligning diverse institutional incentives, as explained through stakeholder theory and institutional economics. It has also led to the underdevelopment of the Indonesian carbon market and made it more difficult to realise its potential as a means of cost-effective and a coping effort of greenhouse gas reduction.

Although no significant amount of fraud in the carbon market has been reported in Indonesia so far, owing to more developed markets, such as the one in the European Union

Emissions Trading System (EU ETS), there exist experiences indicating the possibility of situations when fraud may occur, especially given the weak or inexistent monitoring, reporting, and verification (MRV). Responses on matters of ghost or doubling claims, non-additional project claims, phantom credits, and non-credible credit characterization can be very damaging to credibility, besides policing entities that do not yield any significant effects to the environment, and also to investors with probable far-ranging impacts on reputation and finance.

To sum up, Indonesia is at a very critical juncture. A country of possibilities, it is endowed with both huge natural resources and its strategic location can make it the carbon trading champion of the region. Nevertheless, the transition to making this potential a reality will not only be a matter of regulatory ambition, but it will engage collaborative efforts, institutional reinforcement, and an extended dedication to transparency, environmental integrity, and international support.

By learning lessons from global experience and addressing the gaps that currently exist, Indonesia and other emerging markets will be able to create credible, efficient, and fraud-resistant carbon trading systems. Such systems, when done correctly, can become central to fulfilling national net-zero commitments and play a significant part in meeting global climate mitigation goals.

5.2 Contributions to Knowledge

This thesis makes three main contributions:

1. Empirical: It provides one of the first triangulated analyses of Indonesia's carbon market using both domestic and international perspectives, including newly conducted interviews with EU carbon market actors.
2. Theoretical: It applies stakeholder theory and institutional economics to illuminate how governance design, institutional coordination, and incentive structures influence market credibility.
3. Practical: It offers ten actionable policy recommendations designed to strengthen Indonesia's carbon trading system, including improvements in MRV infrastructure, clearer regulatory frameworks, and alignment with international carbon pricing mechanisms.

5.3 Policy Recommendation

Based on the triangulated findings from document analysis and stakeholder interviews, the following policy recommendations are proposed to strengthen Indonesia's carbon market development:

- a. Establish a Central Carbon Market Authority: Create a legally mandated agency or inter-ministerial task force to oversee and harmonize carbon market policies across MOEF, OJK, IDXCarbon, and other relevant bodies.
- b. Accelerate the Implementation of Carbon Tax Regulations: Finalize and enforce the carbon tax to strengthen the compliance market, signal policy commitment, and create demand for verified credits.
- c. Upgrade MRV and Registry Infrastructure: Invest in digital MRV platforms, blockchain-based registries, and third-party verifier accreditation to ensure transparency, traceability, and scale.
- d. Adopt Transparent Carbon Pricing Mechanisms: Implement auction systems, publish real-time price benchmarks, and set clear cap trajectories to enable effective price discovery and incentivize mitigation.
- e. Develop Article 6-Ready Frameworks: Align domestic offset rules with Article 6 of the Paris Agreement by codifying additionality, corresponding adjustments, and bilateral credit transfer protocols.
- f. Support Market Participation and Liquidity: Provide incentives for SMEs and regional actors to join the market; explore public-private partnership models or credit guarantee funds to support participation.
- g. Integrate AML/CFT Protocols and Fraud Detection Tools: Strengthen fraud prevention by integrating anti-money laundering and counter-terrorism financing standards and deploying anomaly detection tools for transactions.
- h. Facilitate International Recognition and Mutual Recognition Agreements MRAs: Advance bilateral agreements with recognized crediting bodies, e.g., VERRA, and Gold Standard, to facilitate international market access.
- i. Ensure Legal Certainty and Investor Protection: Enact binding regulations that protect carbon credit holders, ensure enforceability of contracts, and guarantee regulatory predictability.
- j. Promote Carbon Market Literacy and Strategic Framing: Raise public awareness and stakeholder literacy, framing carbon markets as integral to national competitiveness, climate resilience, and green growth.

These recommendations aim to move Indonesia's carbon market from the current stage to a credible and scalable emissions trading platform aligned with both domestic goals and international best practices.

5.4 Limitations and Areas for Future Research

The study is limited by its qualitative scope and reliance on a relatively small number of expert interviews. Future research could adopt a mixed-methods approach that includes modeling of credit supply-demand dynamics, pricing simulations, or surveys of market participants. Moreover, as Indonesia's carbon market continues to evolve post-2025, follow-up studies could assess implementation outcomes of the carbon tax, the performance of IDXCcarbon, and regional market linkages under Article 6 of the Paris Agreement.

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APPENDIX

The author formulated interview questions, most of which are open-ended, to enable the collection of rich and detailed information from participants. The interview structure includes an introduction to explain the purpose of the research, ensure confidentiality, and inform participants of the estimated interview duration. This is followed by warm-up questions to understand the participant's role or expertise and familiarity with carbon markets. Thematic questions then explore topics such as fraud mechanisms, regulatory and institutional weaknesses, and possible solutions. The order and wording of questions may vary slightly depending on the stakeholder group to ensure relevance and depth.

In addition, the author asked for closing reflections, further recommendations, and welcomed any additional insights or expert contacts for follow-up consultation. Questions were grouped based on stakeholder relevance as follows:

a. Regulatory Challenges

(For Regulators – OJK, Government Agencies)

1. How would you assess the current regulatory framework governing Indonesia's carbon market?
2. What are the major challenges in enforcing carbon market regulations in Indonesia?
3. Are there gaps or inconsistencies in the implementation of carbon trading policies? If so, what are they?
4. How aligned is Indonesia's carbon market with international agreements (e.g., Paris Agreement, Article 6 of the UNFCCC)?
5. What policy improvements would enhance regulatory clarity and market stability?

(For International Institutions, Academicians, and Practitioners)

1. How does Indonesia's regulatory framework compare with other emerging carbon markets?
2. What regulatory weaknesses or uncertainties do you observe in Indonesia's carbon market?

3. What role should international institutions play in strengthening Indonesia's carbon regulatory system?

b. Market Inefficiencies

(For Market Participants – IDX Carbon, Brokers, Private Companies, Traders)

1. How would you describe the efficiency of Indonesia's carbon market in terms of liquidity and accessibility?
2. What are the main barriers for businesses and investors in engaging with the market?
3. How transparent is price discovery in Indonesia's carbon trading platform?
4. Are there concerns regarding price volatility, and what factors contribute to it?
5. What role do government policies and incentives play in improving market efficiency?
6. (For Practitioners, International Institutions, and Academicians)
7. How do Indonesia's market inefficiencies compare to other emerging carbon markets?
8. What mechanisms could be introduced to improve market participation and pricing stability?
9. Are there structural barriers preventing small and medium enterprises (SMEs) from entering the carbon market?

c. Fraud Risks and MRV Mechanisms

(For Regulators, Market Participants, and Practitioners)

1. What are the key risks of fraud, greenwashing, or market manipulation in Indonesia's carbon trading system?
2. How effective are Indonesia's Monitoring, Reporting, and Verification (MRV) mechanisms in ensuring integrity?
3. Have there been cases of fraudulent carbon credits in Indonesia? If so, what lessons were learned?
4. What improvements can be made to MRV standards to enhance credibility?

5. (For International Institutions and Academicians)
6. What best practices from other countries could help strengthen Indonesia's MRV system?
7. How can digital technologies (e.g., blockchain, AI) improve fraud detection and transparency in carbon markets?

d. Lessons for Emerging Carbon Markets: (For All Participants)

1. What lessons can other emerging carbon markets learn from Indonesia's experience?
2. Are there any specific case studies from other countries that Indonesia should consider adopting?
3. What policy or institutional changes would you recommend to enhance Indonesia's carbon market development?

Final Reflections and Closing Questions

1. If you could recommend one regulatory or market reform, what would it be?
2. What do you see as the biggest risks and opportunities for Indonesia's carbon market over the next five years?
3. Do you have any final thoughts or recommendations for policymakers and stakeholders in Indonesia's carbon market?

Closing Remarks

1. Thank the participant for their time and insights.
2. Inform them about the next steps in the research process.
3. Ask if they are open to follow-up discussions or clarifications.