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# Institutional Readiness for Inclusive Carbon Market Development in Indonesia

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## ABSTRACT

This study explores Indonesia's institutional readiness to develop an inclusive carbon market as a strategic instrument for achieving sustainable development. Using a qualitative descriptive approach and content analysis of national regulations, international best practices, and academic literature, the research examines how carbon schemes—ranging from emissions trading systems and carbon taxes to result-based payments and REDD+—can integrate environmental, economic, and social dimensions. The findings show that while Indonesia holds substantial potential in forestry and land-use sectors to generate carbon credits and attract green investments, institutional gaps remain in regulatory coherence, technical capacity, monitoring and verification systems, and equitable benefit-sharing mechanisms. Evidence from global experiences underscores that successful carbon markets require transparent governance, cross-sectoral coordination, and strong community participation to prevent social inequities and conflicts over land rights. The study highlights that strengthening institutional capacity and embedding inclusivity into policy design are critical for transforming carbon markets from a purely emission-reduction tool into a catalyst for local empowerment and green economic transformation. These findings provide actionable insights for policymakers seeking to balance climate mitigation, economic growth, and social equity in Indonesia's pathway toward a low-carbon future.

**Keywords:** Carbon Market, Institutional Readiness, Sustainable Development, Climate Governance, Social Inclusion.

## INTRODUCTION

The accelerating climate crisis presents a multidimensional challenge for governments, businesses, and societies worldwide (Bandh et al., 2021; Seckin Codal et al., 2021; Toukabri & Boutaleb, 2025). Massive industrialization, deforestation, and overexploitation of natural resources have significantly contributed to rising global temperatures, extreme weather events, and a rapid decline in biodiversity (Singh & Singh, 2017; Kushawaha et al., 2021; Prakash & Verma, 2022). This situation underscores the urgency of developing policy responses that are not only adaptive but also transformative, aiming to achieve an effective and equitable reduction of greenhouse gas (GHG) emissions (Luo & Wattana, 2025; Green & Gambhir, 2019). Addressing these global challenges demands integrated strategies that safeguard ecosystems, stabilize economic systems, and enhance social well-being, while prioritizing the inclusion of vulnerable populations most affected by climate impacts. Such multidimensional approaches form the foundation for achieving a sustainable and just low-carbon transition.

Among the most prominent policy innovations in mitigating climate change is the implementation of carbon schemes—an umbrella term encompassing market and non-market mechanisms designed to internalize the environmental cost of GHG emissions within economic and development systems. These mechanisms include emissions trading systems (ETS), carbon taxes, result-based payments (RBP), and land-based initiatives such as REDD+. By assigning an economic value to carbon emissions, these schemes create financial incentives that encourage emission reductions, technological innovation, and a transition toward green and low-carbon development. However, beyond their technical and financial design, the social dimension remains pivotal. The inclusion of local communities, indigenous peoples, and marginalized groups ensures not only legitimacy and equity but also long-term effectiveness in carbon governance (Hernanz et al., 2025).

Experiences from developed economies demonstrate the potential of carbon schemes to serve as central instruments of climate policy. The European Union Emissions Trading System (EU ETS), China's National ETS, and the Korean ETS have all shown measurable success in reducing emissions while simultaneously stimulating low-carbon technological innovation and creating green employment opportunities (Teixidó et al., 2019; Li & Duan, 2021; Jung & Song, 2023). Similarly, countries such as Sweden, Canada, and Japan have effectively complemented carbon pricing mechanisms with green subsidies and fiscal incentives to accelerate clean energy transitions, creating a balanced policy environment that discourages emissions while fostering innovation and sustainable economic growth (Solarin, 2025; Majanen, 2024; Su et al., 2023). These experiences highlight that carbon markets must be designed not only as economic instruments but also as participatory frameworks that enhance stakeholder engagement and social justice (Green & Gambhir, 2019).

In contrast, developing countries often apply carbon schemes through nature-based and land-use approaches, particularly within forestry and conservation sectors. Programs such as REDD+ and voluntary carbon markets, supported by international and private institutions, have emerged as important mechanisms for climate finance and ecosystem protection (Hernanz et al., 2025). Yet, their success depends heavily on inclusive governance structures that enable meaningful participation from local governments, community-based organizations, and vulnerable populations. Such participatory models ensure that carbon market benefits are distributed equitably, protect land tenure rights, and enhance community resilience, thereby reinforcing both ecological sustainability and socio-economic justice (Schlosberg, 2012; Heyen, 2023).

Indonesia represents a critical case in this global discourse due to its vast tropical forests, rich biodiversity, and strategic position in regional carbon market development. The country possesses substantial potential to participate in both domestic and international carbon schemes, particularly within forestry and land-use sectors (Verstegen et al., 2019; Tomich et al., 2002). These opportunities could unlock green financing, sustainable investment, and employment creation in renewable energy and ecosystem restoration initiatives. Moreover, carbon schemes could serve as a catalyst for sustainable development, aligning environmental protection with economic empowerment and social inclusion (Wahyudi et al., 2025; Wulandari & Salsabiila, 2025). Nevertheless, Indonesia faces persistent challenges, including weak institutional capacity, overlapping land-use policies, and inadequate monitoring, reporting, and verification (MRV) systems. These institutional gaps risk undermining the transparency and credibility of emerging carbon markets. Therefore, this study examines Indonesia's institutional readiness for developing an inclusive carbon market that integrates environmental, economic, and social dimensions. The research aims to identify pathways for strengthening governance, institutional frameworks, and community participation to align carbon market development with principles of climate justice and equitable sustainable growth.

Despite the growing body of research on carbon market mechanisms and climate governance, studies focusing on *institutional readiness*—particularly within the context of developing and emerging economies—remain limited (Sorensen, 2017; Holt et al., 2007; Merriam & Tisdell, 2016). Existing literature has primarily emphasized the economic efficiency and technical design of carbon trading systems, with less attention paid to the socio-institutional dimensions that determine their inclusiveness and long-term viability (Ellerman et al., 2010; Borghesi et al., 2023; Li et al., 2025). This imbalance reflects a critical research gap, as the institutional foundation—comprising governance capacity, policy coherence, and stakeholder participation—is essential for ensuring that carbon markets contribute to both climate mitigation and social equity (Schlosberg, 2012; Heyen, 2023).

In Indonesia's context, most studies have explored carbon market development through the lens of environmental policy and economic feasibility (Wahyudi et al., 2025; Wulandari & Salsabiila, 2025). However, few have systematically analysed how institutional structures, regulatory alignment, and administrative capacity influence the inclusiveness and effectiveness of carbon market implementation. Furthermore, the role of community participation, local governance mechanisms, and social safeguards remains underexplored. These factors are crucial in ensuring that carbon trading frameworks do not exacerbate existing inequalities, but instead generate co-benefits for marginalized populations, particularly those dependent on forest and land-based livelihoods (Verstegen et al., 2019; Tomich et al., 2002). The lack of empirical assessment on institutional readiness

 

thus hinders Indonesia's capacity to operationalize an equitable and transparent carbon market that aligns with global sustainability commitments.

Addressing this gap requires a multidimensional analysis that integrates institutional, policy, and social perspectives into carbon market readiness assessment. The notion of *institutional readiness*—adapted from knowledge management and organizational change theories (Holt et al., 2007)—provides a conceptual framework to evaluate how well governance systems, regulatory frameworks, and social actors are prepared to adopt and sustain low-carbon transitions. Applying this approach to Indonesia allows for a contextual understanding of how institutional capacity, stakeholder engagement, and governance transparency shape the feasibility of inclusive carbon market development. Moreover, such analysis aligns with global debates on just transitions and equitable climate governance, emphasizing the balance between environmental integrity and social inclusion (Green & Gambhir, 2019; Skea & Nishioka, 2008).

Therefore, this research aims to assess Indonesia's institutional readiness for inclusive carbon market development by examining the interactions between policy frameworks, governance mechanisms, and stakeholder participation. Specifically, the study seeks to:

1. Evaluate the current state of Indonesia's institutional capacity, policy coherence, and governance mechanisms related to carbon market implementation.
2. Analyse the extent to which existing institutional frameworks promote or hinder inclusiveness, transparency, and equity in carbon market participation.
3. Identify enabling conditions and institutional barriers that affect the integration of environmental, economic, and social dimensions in carbon market development.
4. Propose policy recommendations and institutional strategies to strengthen readiness and align carbon market governance with principles of climate justice and sustainable development.

By addressing these objectives, this study contributes to the broader discourse on sustainable climate governance and carbon market inclusivity in developing contexts. The findings are expected to inform policymakers, practitioners, and researchers on how institutional strengthening and participatory governance can accelerate the transition toward a just, transparent, and resilient low-carbon economy in Indonesia and comparable nations.

## METHODOLOGY

This study employs a qualitative descriptive methodology aimed at comprehensively examining the potential and challenges associated with the implementation of carbon schemes in promoting sustainable development. The research particularly emphasizes the environmental, economic, and social dimensions, with a focus on the engagement of local and vulnerable communities. Within this framework, the study explores how various policy instruments—including carbon trading, carbon taxation, and non-market mechanisms—can be effectively designed to ensure outcomes that are both equitable and sustainable. In line with the qualitative research perspective articulated by Bogdan and Taylor (as cited in Moleong, 2019), this approach seeks to develop a holistic understanding of social phenomena through the interpretation of non-quantitative data. Similarly, following Merriam and Tisdell (2016), the qualitative descriptive design in this study prioritizes the generation of conceptual insights derived from narrative interpretation and contextual analysis, rather than pursuing statistical generalization.

The research process involves a comprehensive literature review and documentary analysis of secondary data sources. These include national and international regulatory frameworks related to carbon schemes—such as Presidential Regulation No. 98/2021, the European Union Emissions Trading System (EU ETS), and the China ETS—as well as low-carbon development planning documents from KLHK and Bappenas. Additionally, the study analyses scientific publications, institutional reports from organizations such as the UNFCCC, World Bank, OECD, and IEA, alongside academic and practical experiences from other countries. Particular emphasis is placed on assessing the institutional readiness of Indonesia in relation to international carbon trading mechanisms under the Paris Agreement framework. The analysis focuses on how domestic institutions can harmonize with global standards, reporting systems, and market protocols.

Data interpretation is conducted through content analysis, allowing the identification of key themes, policy strategies, and best practices in carbon scheme implementation. Moreover, the study critically assesses the extent to which these policy frameworks incorporate sustainability principles, particularly in terms of social equity, long-term environmental integrity, green economic transformation, and compliance with international carbon market principles.

### Location and Time of Study

This study was conducted as a desk study using literature review and documentation approaches, and therefore was not bound to a specific physical location. Instead, it utilized various national and international secondary data

 

sources. The research was carried out from April to August 2025, covering stages of literature collection, policy review, content analysis of documents, and the preparation and validation of findings. The selected timeframe was intended to ensure access to the most recent and relevant documents, including current-year publications from government agencies, international institutions, and up-to-date scientific journals.

**Data Collection**

In this study, data collection was conducted through literature review and documentary analysis, aligning with the qualitative descriptive research design. The data consisted exclusively of secondary sources, gathered from a wide range of written materials pertinent to carbon schemes, sustainable development, and institutional readiness. These sources encompassed national and regional climate policy documents, legislative instruments such as *Presidential Regulation No. 98/2021*, and reports issued by international organizations including the *IPCC*, *IEA*, and *OECD*. Additional materials included previous research findings, peer-reviewed scientific publications at both national and international levels, and evaluative reports on carbon trading initiatives relevant to the Indonesian context.

The study also examined program evaluation reports, greenhouse gas emission statistics, official government publications, and documents produced by environmental non-governmental organizations (NGOs). Furthermore, data were sourced from materials detailing technological and administrative systems, such as national carbon registries, emission reporting platforms, and carbon accounting mechanisms. As articulated by Bogdan and Taylor (as discussed in Huberman, 2019), qualitative research fundamentally relies on narratives, written texts, and observed actions as central sources of meaning and interpretation. Consistent with this epistemological stance, the present study did not involve direct field observations or interviews, but rather focused on documented and textual evidence as the primary data source.

This methodological choice facilitated a comprehensive and contextual understanding of the dynamic interrelations between carbon schemes and the environmental, economic, and social dimensions of sustainability. Data were systematically organized and analysed through a thematic and contextual literature review process, wherein each document was carefully assessed for its relevance to the research objectives, source credibility, and analytical value in revealing the interconnections among carbon policy mechanisms, technological infrastructure, reporting systems, and their implementation within the broader framework of sustainable development (Huberman, 2019).

**Data Analysis**

The data collected through literature review and documentary analysis were examined using content analysis within a qualitative descriptive framework. This analytical method was applied to identify, categorize, and interpret the information embedded in relevant documents, policies, reports, and scientific publications concerning various aspects of carbon schemes. The use of content analysis enabled a systematic exploration of the interconnections between carbon policy mechanisms and their contributions to the environmental, economic, and social dimensions of sustainable development. The analytical process was structured into three main stages. The first stage, data reduction, involved selecting and focusing on information directly pertinent to the research objectives—such as the potential implementation of carbon schemes, international best practices, and the challenges and opportunities identified across different contexts. The second stage, data presentation, entailed organizing the refined data into thematic narratives, tables, and diagrams to facilitate the identification of patterns, relationships, and interdependencies among variables. The final stage, conclusion drawing and verification, involved synthesizing the findings to derive logical, coherent, and contextually grounded insights aligned with the study's overarching objectives.

As articulated by Bogdan and Taylor (as cited in Huberman, 2019), qualitative data analysis emphasizes the interpretation of meanings underlying textual and verbal information, rather than quantifying their frequency or magnitude. Guided by this interpretive paradigm, the present study analyzed documents not only for their explicit content, but also for the broader socio-political and economic contexts that shape carbon policy frameworks. The analytical procedure also incorporated an evaluation of transparency and disclosure mechanisms, focusing on institutional practices in emission reporting, carbon credit management, and transactional governance. These elements are crucial in promoting accountability, credibility, and stakeholder confidence within carbon market systems. Through this systematic and interpretive approach, the study aims to construct a comprehensive and contextual understanding of how carbon schemes can operate as strategic policy instruments for advancing sustainable development in Indonesia, while integrating relevant international experiences within the nation's local socio-institutional context (Huberman, 2019).

 

**Sustainable Development Dimensions in Carbon Trading: An Institutional Readiness Theory Approach**

This study examines the implementation of carbon schemes as strategic instruments for global climate change mitigation through the analytical lens of Institutional Readiness Theory (IRT) developed by Holt et al. (2007), complemented by perspectives from New Institutionalism as articulated by North (1990) and Scott (2014) (Sorensen, 2017). This theoretical framework provides a comprehensive foundation for understanding how institutional readiness influences the design, management, and supervision of carbon schemes in ways that ensure both effectiveness and sustainability. Carbon schemes—whether market-based mechanisms such as emissions trading systems (ETS) or non-market instruments like carbon taxes and results-based payments—serve to internalize the external costs of greenhouse gas (GHG) emissions within the economy. By doing so, they encourage businesses, governments, and communities to adopt low-carbon practices that are efficient, measurable, and accountable (World Bank, 2021). However, successful implementation depends not only on the technical design of the instruments or market efficiency, but also critically on the readiness and capacity of institutions that govern and oversee these systems.

IRT identifies four interrelated dimensions of institutional readiness essential for sustainable carbon governance. First, clear and consistent policies and regulations are required, including explicit legal frameworks, compliance obligations, and enforcement mechanisms to reduce uncertainty and provide a stable normative foundation. Second, adequate institutional and technical capacities—encompassing skilled human resources, advanced technology, and robust infrastructure—are vital to operational success (Holt et al., 2007). Third, transparency and accountability mechanisms must be credible to build public trust and stakeholder confidence. Finally, inclusive multi-stakeholder coordination ensures broad-based participation among government agencies, the private sector, civil society, and local communities. Together, these dimensions form a coherent institutional framework supporting the effective and equitable implementation of carbon schemes (North, 1990; Scott, 2014).

From a sustainable development perspective, carbon schemes possess significant transformative potential across environmental, economic, and social dimensions. Environmentally, they promote GHG emission reductions through energy efficiency, forest conservation, deforestation prevention, and land-based mechanisms such as REDD+, thereby enhancing ecosystem integrity and carbon sequestration (UNFCCC, 2022). Economically, they generate market value from verified emission reductions, stimulate green investment, create revenue streams through carbon credit trading, foster technological innovation, and improve industrial competitiveness (OECD, 2021). Socially, inclusive implementation empowers local communities through green job creation, capacity building, and fair access to economic benefits derived from sustainable natural resource management. Collectively, these three dimensions constitute the sustainability tripod fundamental to long-term development (Sachs, 2015). Yet, the success of carbon schemes must also be evaluated through the lenses of environmental justice and social equity. As argued by Miranda and Farrin (2012), these mechanisms should simultaneously protect the environment and advance the welfare of vulnerable groups, ensuring a fair distribution of benefits and burdens. Contemporary scholarship further underscores the importance of embedding justice principles into climate policies to prevent social exclusion and enhance policy legitimacy (Schlosberg, 2013; Newell et al., 2021). Applying IRT enables local governments and stakeholders to construct credible, inclusive, and sustainable carbon governance systems, strengthen institutional weaknesses, and foster cross-sector collaboration—ensuring equitable benefit-sharing while enhancing climate mitigation and adaptation capacities (Holt et al., 2007; Sorensen, 2017).

In the Indonesian context, effective implementation of carbon schemes demands strong coordination across national, regional, and local levels of governance to ensure policy coherence and consistency in regulatory frameworks and incentives (KLHK, 2023). Multi-level governance facilitates the integration of national carbon market goals with regional development planning, land-use management, and community-based initiatives, thereby minimizing policy fragmentation and resource conflicts (Bappenas, 2021). Enhanced collaboration among central agencies, provincial authorities, and local governments allows institutions to harmonize Monitoring, Reporting, and Verification (MRV) systems, align emission reduction targets, and ensure equitable benefit distribution to all stakeholders, including vulnerable populations. Moreover, such coordination enables local adaptation of national strategies, the incorporation of indigenous knowledge in land and forest management, and the enhancement of public participation in carbon market programs (KLHK, 2022). Embedding multi-level governance thus strengthens institutional readiness, reinforces policy coherence, and secures the long-term sustainability and legitimacy of carbon schemes across all administrative levels (North, 1990; Scott, 2014).

Finally, stakeholder awareness and education are indispensable for the effective operation and long-term acceptance of carbon markets. Capacity-building initiatives aimed at government officials, private sector actors, and local communities can enhance understanding of carbon pricing, compliance procedures, monitoring frameworks, and the socio-environmental benefits of carbon policies (IEA, 2023). Public outreach and training programs further serve to demystify carbon markets, build trust, and encourage active engagement from marginalized groups. By equipping all stakeholders with knowledge, technical competence, and motivation,

 

institutions can enhance transparency, community participation, and the widespread adoption of low-carbon practices. Integrating stakeholder education and awareness within the IRT framework ensures that all actors are not only informed but also empowered to contribute to a sustainable and inclusive carbon market ecosystem (Holt et al., 2007; Sorensen, 2017).

## RESULTS AND DISCUSSION

### Global Success of Carbon Schemes

Carbon schemes, encompassing market-based mechanisms such as Emissions Trading Systems (ETS) and non-market mechanisms including carbon taxes, Result-Based Payments (RBP), and land-based initiatives like REDD+, have become key instruments in global climate change mitigation strategies (Stern, 2021; World Bank, 2022; IPCC, 2023). These instruments create economic incentives that internalize the external costs of greenhouse gas (GHG) emissions while encouraging technological innovation and behavioural shifts toward a low-carbon economy (OECD, 2022; IEA, 2023). Beyond institutional readiness, the effectiveness of these schemes is influenced by their economic, social, and environmental impacts, including equity in benefit distribution, community participation, ecosystem preservation, and contributions to green growth (Liu et al., 2022). Governed under the United Nations Framework Convention on Climate Change (UNFCCC), carbon schemes have been adopted by both developed and developing countries, with varying designs and degrees of success (UNFCCC, 2021).

Empirical studies highlight the critical role of institutional readiness in the effectiveness of these schemes. For instance, the European Union Emission Trading Scheme (EU ETS), launched in 2005, has reduced emissions by 3–5% during its initial phase through adaptive cap-and-trade mechanisms, data transparency, and cross-sector collaboration, covering over 14,000 facilities across 30 member states (Ellerman et al., 2016; European Commission, 2020). However, these mechanisms also had social and economic implications, such as employment shifts in energy-intensive sectors and incentives for green investment, demonstrating the need for integrated policy design that balances environmental, economic, and social objectives (Perino & Willner, 2017). Despite these achievements, challenges such as fluctuating demand highlight the need for complementary policies, including carbon floor pricing, social safeguards, and innovative financing mechanisms, to ensure long-term effectiveness (World Bank, 2023).

In Asia, China's National ETS, initiated in 2021, demonstrates that strong regulations, enhanced Monitoring, Reporting, and Verification (MRV) systems, and consistent political commitment from central to local governments are crucial for success (Zhang et al., 2022; He et al., 2023). Moreover, the program has social and economic dimensions, influencing urban employment, industrial competitiveness, and public awareness of sustainable practices (Wang & Li, 2023). Similarly, Japan's Tokyo Cap and Trade Program achieved a 27% reduction in commercial building emissions over a decade by combining energy efficiency incentives, emission reduction certifications, and programs supporting tenant engagement and energy behavior change (Sugiyama et al., 2021).

In North America, Canada's combination of carbon tax and Output-Based Pricing System (OBPS) effectively reduced fuel consumption while maintaining economic growth, and subnational ETS programs in the United States, such as Quebec's cap-and-trade linked with California, have reduced emissions while funding environmental restoration and community programs, addressing both social and ecological goals (Harrison, 2020; Rabe, 2022). In Oceania, New Zealand's ETS, covering nearly all sectors including forestry, has successfully promoted afforestation and forest conservation as carbon assets (Ministry for the Environment New Zealand, 2022). Comparative studies across 121 countries indicate that a carbon price increase of USD 10 per ton $CO_2$ can reduce per capita emissions by 1.3% in the short term and up to 4.6% in the long term (Metcalf & Stock, 2020), underscoring the multidimensional impacts of carbon pricing across economic, social, and environmental domains.

These analyses underscore that the success of carbon schemes depends heavily on strong institutional readiness, which includes clear legal frameworks, reliable data-based monitoring systems, and close collaboration between central governments and private sectors (North, 1990; Ostrom, 2005). This aligns with Institutional Readiness Theory, emphasizing the synergy among regulation, technical capacity, transparency, and multi-stakeholder coordination (Scott, 2014). New Institutionalism perspectives further stress the importance of social norms and culture in strengthening policy legitimacy and sustainability (DiMaggio & Powell, 1983; Meyer & Rowan, 2006).

Indonesia, with its substantial potential in REDD+ and forestry-based carbon markets, holds strategic opportunities to develop inclusive carbon schemes integrated into sustainable development (Ministry of Environment and Forestry Indonesia, 2023). However, challenges such as limited technical capacity, overlapping sectoral authority, and weak MRV mechanisms may hinder effectiveness and exacerbate social or economic inequities (Santoso et al., 2023). Strengthening institutional readiness through regulatory improvements, technical

 

capacity building, data transparency, and enhanced multi-stakeholder coordination is therefore critical to ensure that carbon schemes serve as effective climate mitigation tools while driving equitable and sustainable development transformation (Booth, 2021).

**Potential of Carbon Schemes in Sustainable Development Dimensions**

Carbon trading has emerged as a strategic global environmental policy instrument in addressing climate change. As a market-based approach, carbon schemes provide financial incentives for countries and businesses to reduce greenhouse gas (GHG) emissions through compensation mechanisms and carbon market instruments (Stern, 2021; World Bank, 2022). Beyond emission reduction, these schemes serve as an integrative bridge linking environmental, economic, and social interests, supporting a holistic approach to sustainable development (UNFCCC, 2021; Liu et al., 2022). By aligning market incentives with sustainable practices, carbon schemes encourage actors across sectors to adopt low-carbon strategies while fostering institutional innovation and multi-stakeholder engagement (OECD, 2022; IEA, 2023).

Carbon schemes contribute significantly to environmental sustainability through GHG reduction, forest conservation, and biodiversity protection (IPCC, 2023). Their success, however, depends heavily on institutional readiness, including policy frameworks, governance, technical capacity, and multi-actor support (Scott, 2014). The European Union Emission Trading Scheme (EU ETS) initially reduced emissions by 3–5% and promoted low-carbon technologies such as carbon capture and storage (CCS) in steel and power industries (Ellerman et al., 2016; European Commission, 2020). Similarly, China's National ETS, launched in 2021, reduced emissions in energy and industrial sectors by 3–5% annually while shifting investments toward renewable energy (Zhang et al., 2022; He et al., 2023). In Indonesia, REDD+ programs in Kalimantan and Papua demonstrate the potential of forestry and peatland as natural carbon sinks, though challenges remain, including land-use conflicts, weak law enforcement against illegal deforestation, and limited MRV mechanisms (Santoso et al., 2023). To address these challenges, this study emphasizes the importance of performance evaluation and feedback mechanisms, such as continuous monitoring, reporting, and verification (MRV), adaptive management, and periodic assessment of environmental, economic, and social outcomes, to ensure that carbon schemes remain effective and responsive (Huberman, 2019). Institutional readiness, solid emission data systems, and strong governmental and industrial commitment are critical to ensuring long-term environmental benefits (Booth, 2021).

Carbon trading is not only a climate mitigation tool but also a catalyst for new economic opportunities. Each ton of carbon reduced generates financial value, creating domestic and international carbon markets and attracting private investments in reforestation, renewable energy, sustainable agriculture, and energy efficiency projects (Metcalf & Stock, 2020; Harrison, 2020). The EU ETS has generated billions of euros annually from auction revenues, funding large-scale renewable energy projects such as offshore wind farms (Perino & Willner, 2017; European Commission, 2020). In North America, California–Quebec's cap-and-trade program has collected over $28 billion in ten years, funding more than 500,000 projects, creating 30,000 jobs, and reducing emissions equivalent to 25 million cars (Rabe, 2022; World Bank, 2023). In Indonesia, the implementation of the Carbon Economic Value (NEK) under Presidential Regulation No. 98/2021 allows state-owned enterprises such as Pertamina and PLN to explore carbon credit sales from energy efficiency, biomass co-firing, and large-scale solar power projects, providing additional revenue for green development and clean energy infrastructure (Ministry of Environment and Forestry Indonesia, 2023). These schemes also incorporate feedback loops through performance tracking and reporting, which inform policy adjustments, improve program design, and enhance transparency for investors and stakeholders (Ostrom, 2005; North, 1990).

Community-based carbon schemes offer significant potential to empower local populations if designed inclusively. Instruments such as REDD+ and voluntary carbon markets provide opportunities for local and indigenous communities to participate actively in forest protection and sustainable resource management (Murdiyarso et al., 2021; DiMaggio & Powell, 1983). Empirical evidence from Africa, Asia, and Latin America shows that carbon trading can enhance social welfare by providing financial incentives, skills training, and green employment opportunities, while also posing challenges such as unequal access, benefit disparities, and additional burdens on vulnerable groups, particularly women (Liu et al., 2022; Meyer & Rowan, 2006). Implementing systematic feedback mechanisms at the community level, such as participatory monitoring and evaluation, ensures that social benefits are equitably distributed and that local voices inform program improvements (Booth, 2021; Huberman, 2019).

In Indonesia, REDD+ programs have generated additional income through Result-Based Payment (RBP) schemes, yet benefits remain uneven due to limited local institutional capacity, low community participation, and suboptimal benefit-sharing mechanisms (Santoso et al., 2023). Without robust governance, transparent institutional processes, and structured performance evaluation systems, carbon schemes risk social resistance and diminished legitimacy (Scott, 2014; North, 1990). Across environmental, economic, and social dimensions, evidence from global experiences emphasizes that institutional readiness—comprising clear regulations, technical capacity,

 

transparency, inclusive coordination, and effective monitoring and feedback mechanisms—is a prerequisite for maximizing the transformative potential of carbon schemes (Ostrom, 2005; Stern, 2021). For Indonesia, leveraging forestry and land-based carbon opportunities while strengthening institutional frameworks and performance evaluation systems offers a pathway to achieve equitable, low-carbon, and sustainable development outcomes (Ministry of Environment and Forestry Indonesia, 2023).

## CONCLUSION

Carbon schemes, whether through market-based mechanisms such as the Emissions Trading System (ETS) or non-market mechanisms such as carbon taxes, Result-Based Payments (RBP), and REDD+, have emerged as strategic instruments supporting the global sustainable development agenda. These instruments not only serve as tools for controlling greenhouse gas (GHG) emissions but also act as catalysts for economic transformation, environmental governance, and social welfare enhancement. Environmentally, carbon schemes have demonstrated effectiveness in reducing emissions, conserving forests, and protecting biodiversity. Economically, carbon markets and pricing policies generate new financial value from emission reductions, attracting private investment in renewable energy, reforestation, and energy efficiency innovations. Socially, these schemes provide opportunities for local community empowerment through green job creation, increased local income, and corporate social responsibility (CSR) programs funded by carbon revenues.

Overall, carbon schemes have the potential to be transformative instruments for sustainable development if supported by well-designed policies, strong institutional readiness, credible monitoring and verification systems, and active stakeholder participation. Experiences from various countries demonstrate that integrating environmental, economic, and social objectives through carbon schemes is not only feasible but also a strategic step toward addressing the global climate crisis. Effective policy design and robust institutional frameworks are essential to maximize the impact of these instruments.

With proper integration and strong institutional support, carbon trading can become a critical pillar in promoting holistic sustainable development. Beyond reducing global emissions, carbon schemes offer a strategic pathway to achieving social equity, green economic growth, and long-term ecological sustainability. Their implementation highlights the importance of aligning climate mitigation efforts with inclusive economic and social outcomes, ensuring that the benefits of low-carbon transitions are widely shared.

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