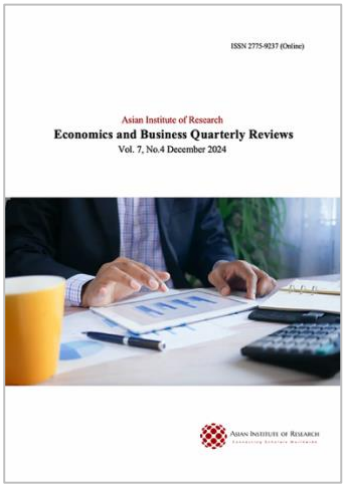

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Identification and Implementation of Carbon Emission Disclosures and Subsidiaries in Indonesia in Comparison to Brazil and Congo: An Overview Study

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Abstract
Objectives: The quantity of CO2 emissions that combustion energy sources in power plants, cars, industry, business sectors, households, and other sectors emit into the atmosphere would influence global warming. Therefore, reducing global warming may be achieved by energy efficiency technology and low-carbon energy sources. By examining how MRV, a ground-breaking REDD+ technology from Indonesia, Brazil, and Congo Governance, transformed forested landscapes into carbon domain that could be observed and controlled via the use of data-intensive mapping and techniques model. Theoretical Framework: To reduce deforestation, REDD+ was initially designed to be a scheme in which rich countries would compensate poor countries with trees (maybe through carbon markets). However, there have been questions over whether REDD+ will lead to significant reductions in emissions. Carbon reductions in the forest sector are becoming increasingly important for reducing emissions and meeting the NDC. Method: This study looks at literature reviews as a research method in addition to giving an overview of the many types of reviews and some standards for conducting and assessing literature review articles regarding carbon emission declarations and subsidiaries in Congo, Brazil, and Indonesia might be used. Result and Discussion: This study should be identified and analysed as follows: (i) Districts and regionals should be given incentives to produce or harvest more timber instead of disincentives from Nation Governance; (ii) State Forest mining fees should be increased to fully defray the costs of reclamation and rehabilitation of areas mined; (iii) Tightening technical requirements for underground mining in protection forests would limit the number of mining permits that local governments could be granted. Research Implications: This study achieved sustainable and equitable growth for everybody, there will need to be greater global collaboration on trade and climate change about carbon emission disclosures and subsidiaries. Originality/Value: This study identified and analysed carbon emission disclosures and subsidiaries in Indonesia, Brazil, and Congo also how to imply the regulations among those country.

Keywords: Carbon Emission, Carbon Emission Disclosure, Carbon Subsidiary

1. Introduction

Energy production has been mostly dependent on burning fossil fuels since the start of the second industrial revolution, which was characterized by mass manufacturing and the creation of electricity. Large amounts of CO_2 have been emitted into the atmosphere during the past few decades by power plants, cement manufacture, and the use of fossil fuels in many houses (Trilestari & Murwanto, 2022). Since then, the severe impacts of CO_2 on the ecosystem and the atmosphere's ever-increasing concentration have caused much alarm (Yu et al., 2018). If efficient technology and low-carbon, eco-friendly fuels are not used in tandem, this will lead to an increase in CO_2 emissions (Zarin et al., 2016).

The rate of global warming is impacted by the amount of CO_2 emissions released into the atmosphere by combustion energy sources in power plants, automobiles, industry, business sectors, homes, and other sectors. Thus, the utilization of low-carbon energy sources and energy efficiency technologies can help reduce global warming. According to Yuliandhari and Ayustyara (2023), emission levels from business as usual, the Indonesian government has committed to reducing GHG emissions by 26% within ten years using domestic resources as part of the global climate change solution. Furthermore, emission reductions of up to 41% can be achieved with international support for our mitigation efforts (Verchenkova et al., 2019).

Climate change and opportunity risk (CC), energy consumption (EC), greenhouse gas reductions and costs (RC), accountability of carbon emissions, and greenhouse gas emissions computation are among the measures for carbon emissions (Basuki et al., 2022). A quarter of the emissions reductions committed by Parties to the United Nations Framework Convention on Climate Change (UNFCC) in their Nationally Determined Contributions (NDCs) come from reductions in land use, especially forests (Azar, et al., 2021). The UNFCCC's Montreal Conference of the Parties (COP) in 2005 was the first forum for discussing reducing emissions from deforestation as a potential worldwide contribution to slowing down climate change (Begum et al., 2015).

Following its inclusion in the UNFCCC's climate discussions in Bali, Indonesia in 2007, Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) was eventually incorporated into the 2015 Paris Agreement on Climate Change. The NDCs' pledged reductions in emissions might be fulfilled unconditionally, conditionally, through REDD+ with outside assistance from other nations, or through a mix of the two. REDD+ was originally intended to be a program wherein wealthy nations would pay poor countries with forests to minimize deforestation and forest degradation. Nonetheless, there have been doubts about whether REDD+ would result in appreciable emission reductions.

Dirgantara (2022) identified several reasons that cause government officials, consultants, and academics to become concerned about the implementation of REDD+ and its results. First, it took eight years for REDD+ to be officially included in the climate change discussions and eventually included in the 2015 Paris Agreement. Although it makes sense for those worried about high emissions from forests to want REDD+ to be implemented quickly, international negotiations often take time, as seen by the amount of time it took to establish an agreement in Paris. The second contributing cause is the apparent exclusion of a market-based strategy from the "result based payments" method outlined in Article 5 of the Paris Agreement for the implementation of REDD+. The anticipated tens of billions of dollars that had been demanded to decrease emissions from deforestation and forest degradation may not materialize because of this decision (Li et al., 2022). The third is the practical challenges associated with reducing emissions from forestry: corruption and the potentially higher cost of reducing forestry emissions than first thought are just two of the many issues that could impede the complex national institutional and governance arrangements needed to implement REDD+ (Astuti & McGregor, 2015). Therefore, there is very little chance that industrialized nations will contribute the necessary financial resources unless there is a market for forestry carbon credits that channels money from the private sector toward initiatives to lower emissions from forests (Nkengfack & Fotio, 2019).

Sub-Saharan Africa is equally, if not more, exposed to the negative effects of this externality than the world's major polluters in China, the United States of America, the European Union, Brazil, and Russia even though the region only contributes 3 to 4% of global greenhouse gas emissions (Jebli et al., 2015). These nations must strike

a fair balance between the pursuit of economic expansion and the preservation of environmental quality due to the global public benefit property of the environment on the one hand, and the transferable character of air pollution on the other.

High energy use ultimately results in environmental pollution, most frequently in the form of CO_2 emissions. For these reasons, Apergis et al. (2017) stated that it is crucial to quantify the temporal variability and trends of carbon emissions resulting from deforestation. First, part of the interannual fluctuation in atmospheric CO_2 concentration may be explained by it. According to Choi et al. (2013), tropical terrestrial ecosystems are the primary cause of the inter-annual variability of the global CO_2 growth rate, with positive anomalies associated with El Niño and negative anomalies associated with La Niña. Second, comprehending the intricate and dynamic drivers of deforestation requires an understanding of the trend in deforestation. Third, actions aimed at lowering emissions from deforestation and forest degradation are probably much influenced by knowledge of the trend and variability of past emissions (REDD+).

The deforestation map products produced by this research determined each Moderate Resolution Imaging Spectroradiometer (MODIS) pixel's year of forest removal in the Amazon basin (Song et al., 2015). A total of 15.9 ± 2.5 million hectares of forests were lost between 2000 and 2010, which equates to 2.6% of the basin's total area or 2.9% of its forests in 2000, which over those ten years, the forests in the Brazilian and non-Brazilian Amazons lost a combined 12.5 ± 2.0 million hectares and 3.4 ± 0.5 million hectares, respectively (Assis et al., 2020). With 79% of all destroyed forests, Brazil was the largest country in terms of deforested land (Mudiyarso et al., 2018). Brazil has lost a significant amount of forest in recent years since 1990, an estimated 80 million hectares of natural forest have been lost in Amazon (Richards et al., 2017).

Significant greenhouse emissions from deforestation have traditionally outperformed emissions from all other industries. Since the mid-2000s, there has been a 74% decrease in net land-use emissions and a decrease in deforestation due to effective governance (Wiltshire et al., 2022). The removal of carbon emission from protected areas and secondary forest regrowth has increased by 62%, which has contributed to the decrease in net emissions and offset the 44% decrease in gross emissions (INPE, 2021). Reducing emissions and reaching the NDC depend more and more on carbon reductions in the forest sector. Through improved regrowth, the Brazilian goal of 12 million hectares of reforestation and restoration may be able to significantly offset emissions, but Brazil's natural carbon sinks are becoming less effective (Heinrich et al., 2021).

Due to the extremely high rates of deforestation in the nation, Indonesia was a pioneer in the REDD+ movement, launching several national and subnational projects as well as technical programs (Indriyani et al., 2020). The Indonesian Government made a bold and voluntary commitment in 2009 to reduce emissions by 26–41% by 2030, contingent on the amount of foreign financing received (Hapsari et al., 2020). Additionally, it offers technical training and capacity building to organizations and other groups involved in carbon accounting at the national, provincial, and project levels (Fischer et al., 2023). Given the creation of a plan, the significant coordination of data and information systems, and the involvement of several agencies, it appears that Indonesia has institutionalized its measurement, recording, and verification (MRV) process to a "deep" level (Cahyono et al., 2023).

By looking at the experience of the governments of Indonesia, Brazil, and Congo, MRV works as a pioneering technology of REDD+ and how it converts forested landscapes into observable and controllable carbon domains through data-intensive mapping and modeling procedures. The task of limiting and rerouting human activities that lead to forest mortality and the unintentional release of greenhouse gases (GHGs) is presented by reconfiguring the forest as a biome of carbon storage (Gill et al., 2017; Wang et al., 2019). This reconfiguration also initiates a variety of governmental actions intended to make forests more alive.

The claim that forest degradation is less than 10% of emissions from all sources might exclude the accounting under the World Bank methodological framework for REDD+ (World Bank, 2021). Estimates of emissions from all sources of forest degradation were less than 10% in just 11 countries. The more arid nations of North and East Africa and South Asia were found to produce the largest percentage of degradation emissions (>75%) as compared

to overall emissions (Le Quéré et al., 2020). The largest forested nations, followed by Brazil, Congo, and Indonesia, have the highest total emissions of degradation.

Given the background, this paper aimed to identify and analyze carbon emission disclosures and subsidiaries in Indonesia in comparison to Brazil and Congo. This paper examined how Measurement, Reporting, and Verification (MRV) of carbon credits, an innovative REDD+ (Reducing Emissions from Deforestation and Forest Degradation) technology, transformed forested landscapes in these countries into carbon domains that could be monitored and managed using data-intensive mapping and modeling techniques. The theoretical framework for this study is grounded in the following concepts: (1) biopolitics and environmental governance which involves the governance of populations through the management of life and biological processes. In the context of environmental governance, biopolitics is manifested through the control of ecosystems and the quantification of environmental services such as carbon sequestration (see Agamben, 1998; Robertson, 2012); (2) MRV Technologies and Carbon Markets, in which MRV systems are essential for accurately measuring carbon stocks, reporting emissions reductions, and verifying the authenticity of carbon credits. These technologies facilitate market-based mechanisms like REDD+ by providing the data needed for trading carbon credits (see Gupta & Mason, 2016; Goetz, 2015; Skutsch & McCall, 2010); (3) Geographical disparities in carbon emissions which identify significant geographical variations in carbon emissions, with arid regions contributing more to degradation emissions. This highlights the need for tailored REDD+ strategies that consider regional differences in forest cover and degradation (see Houghton & Nassikas, 2017; FAO, 2016); Pan et al. 2011). This theoretical framework combines the concepts of biopolitics, MRV technologies, and geographical disparities to provide a comprehensive approach for understanding the implementation and impact of REDD+ initiatives in Indonesia compared to Brazil and Congo. It highlights the importance of precise measurement and governance in managing carbon emissions and reflects the complex interplay of power, knowledge, and environmental stewardship.

2. Literatures

2.1. Carbon Emission Disclosure

Companies' environmental disclosures usually contain sections on carbon emissions, energy conservation, performance in relation to carbon emission reduction targets, greenhouse gas intensity, and methods to safeguard the environment from the effects of global warming, its ramifications, and potential climate change (Allam & Diyanty, 2020). Climate change and opportunity risk (CC), greenhouse gas emissions (GHG) computation, energy consumption (EC), greenhouse gas costs and reductions (RC), and carbon emissions accountability (ACC) are among the revealed carbon emissions. A component of carbon emission disclosure that provides information and demonstrates business responsibility for the environment in which its operations are conducted is the disclosure of carbon emissions (Raihan, 2023).

Carbon emission disclosure from company operations is now included in environmental disclosure due to public pressure and the rising intensity of carbon emissions (Andrian & Kevin, 2021). Jebli et al. (2015) defined that the carbon trading system is a market-based mechanism to reduce greenhouse gas emissions from residential buildings through unit sales transactions. As part of the efforts to assist the government in lowering carbon emissions and the environmental effect produced by carbon emissions originating from company activities, disclosure of carbon emissions is one type of corporate responsibility to the environment (Setiawan & Iswati, 2019).

It is imperative that carbon emission disclosure be included in sustainability reports sent to energy sector companies (Rozak & Junaedi, 2022). However, according to Xu et al. (2017), disclosure of carbon emissions is still optional, meaning that some companies have not done so. Typically, those who report this kind of information are those whose operations have a direct bearing on the environment and natural resources (Lin et al., 2015). The carbon emission disclosures made by the environmental elements include information on carbon emissions, which cover topics such as greenhouse gas intensity, performance in relation to targets for reducing carbon emissions, energy conservation, and methods to safeguard the environment from the effects of global warming, its after-effects, and potential climate change (Fosten et al., 2012; Daromes, 2020).

2.2. Carbon Subsidiaries: Its Pricing, Tax, and Trading

A subsidiary is a public or private organization that is under the management of another organization, which can happen through mergers, acquisitions, consolidation, or special purpose companies (Evana & Lindrianasari, 2021). Brearley et al. (2019) stated that both subsidy programs are significant moves in the right direction toward lowering greenhouse gas emissions and quickening climate action, but they run the risk of intensifying trade disputes and pushing underdeveloped and rising nations aside. To achieve sustainable and equitable growth for everybody, there will need to be greater global collaboration on trade and climate change (Grassi et al., 2017).

At this point, the Government should not support or grant a social permission for the exploitation of fossil fuels to continue, and some advocates of carbon capture and removal are concerned that the practice may damage the public's opinion of these industries (Groom et al., 2022). It is also reasonable to worry that energy corporations may find a method to manipulate these credits so they may charge for projects that do not actually remove or store away the reported amount of carbon dioxide (Piabuo et al., 2021).

Carbon pricing refers to two policy options, namely emissions trading and carbon taxes, which create a financial incentive to minimize emissions through price signals (Tacconi & Muttaqin, 2019). Carbon pricing is a market-based program for reacting to climate change, notably in addressing environmental challenges such as greenhouse gas (GHG) emissions (Fulton et al., 2017). A cap on the total emission level that lets the market set the price is the main goal of emissions trading, sometimes referred to as the Emissions Trading Scheme (ETS) or Cap and Trade (C&T), which enables the government to designate a general emission target for these industries and facilities and to determine which industries and facilities emit a particular pollutant (Fasihi et al., 2019).

Additionally, a restricted number of permits that enable the discharge of a particular amount of a particular pollutant (usually CO_2) over a predetermined period may be distributed and sold by the Government (Boer, 2020). To provide producers, consumers, and investors with financial incentives to choose lower-emission options without sacrificing their ability to compete, the ETS converts a statutory limit on emissions into an emissions price determined by the market (Ali et al., 2022).

On the other hand, a carbon tax establishes a price that allows the market to decide the total amount of emissions (Verchenkova et al., 2019). To put it plainly, Basuki et al. (2022) defined that people who generate greenhouse gases are subject to a carbon tax. By equalizing the marginal social cost of reducing carbon emissions and the marginal social benefit resulting from the mitigation of global warming, it aims to internalize the global external cost associated with CO_2 emissions and is thought to be effective for the use of the atmosphere in terms of carbon emissions (Jiang et al., 2023).

It also aims to internalize externalities associated with anthropogenic climate change, making it a workable way to have producers and consumers consider the social cost of pollution that increases greenhouse gases (Nkengfack & Fotio, 2020). When properly crafted and put into action, ETS and carbon taxes encourage businesses (and/or people) to engage in pollution control activities that serve both their personal interests and the purposes of the policy, resulting in harnessing market forces (Yuliandhari & Ayustyara, 2023).

3. Research Methodology

This study employed qualitative approach with a literature study method design. A literature review is an extensive analysis of all the journals that have been published in each field of study or line of inquiry, often over a given time frame (Creswell & Poth, 2018). In addition to providing an introduction to the various reviews and criteria for performing and evaluating a literature review article, this study examines literature reviews as a research approach. It also covers typical difficulties and how to produce literature reviews. It can take the form of an annotated list or an in-depth critical bibliographic article that highlights the most important journal articles about carbon emission disclosures and subsidiaries in Indonesia, Brazil, and Congo.

4. Result and Discussion

4.1. Carbon Emission Disclosure as Global Biopolitics

The derived notion of biopolitics encompasses a set of actions intended to control human (and maybe non-human) existence, with an emphasis on depicting, elucidating, and subsequently managing the well-being of the populace. The biological activities of living things, such as those connected to birth, death, production, and sickness, are quantified, and aggregated throughout the population as the objects of biopolitics (Boer, 2020). The goal of the ruling class is to subjugate physical bodies in ways that serve as a microcosm of the larger population to control and manage life.

This information helps identify the kinds of projects or programs that are feasible and potential locations for them, which is helpful for both public and private investors looking to create carbon offsets. When carbon is mixed with detailed knowledge of the socioeconomic circumstances and means of subsistence of forest communities, these individuals become fundamental to the new resource commodity (Achille et al., 2021). In fact, by reducing complex events to biological assets and costs that can be represented and altered within a commercialized formula, this calculation of life aligns with neo-liberal rationalities (Fulton et al., 2017).

Therefore, according to Verchenkova et al. (2019) biopolitics is linked to more general methods that compile and collect unique life patterns and use this as the foundation for diverse political approaches. The dynamic process by which contemporary human and natural sciences, together with the normative ideas that flow from them, organize, and define the objectives of political activity is embodied in the field of biopolitics (Azar et al., 2021). It incorporates several techniques for classifying and dividing the populace and the economy into issues that call for government intervention.

Nonetheless, Fischer et al. (2023) stated that biopolitical tactics are not exclusive to other governing models, which are conceptualized within the framework of governmentality. Governmentality focuses on specific political reasoning approaches, the use of certain terminology and expertise, and how they relate to methods of enforcing the law and running the state (Raihan, 2023). Thus, the way power operates within the many strategies and behaviours of governance is intimately linked to thought and knowledge.

Although the idea of biopolitics primarily focuses on the interactions between the state, the human population, and nature, it has also been easily extended to the state-human interaction with the natural world (Nkengfack & Fotio, 2019). A sort of biopolitics is the extreme focus on comprehending the life and well-being of the environment; it is cantered on recognizing, documenting, and modelling the statistical hazards to nature, followed by the creation of management initiatives. Underlying the biopolitics of forest carbon are universal calculative mechanisms that convert forests into assessable and possibly controlled carbon regions for governments and non-state actors (Evana & Lindrianasari, 2021).

By recognizing trends and patterns and then determining the best strategies to reduce risk, biopolitics helps define the boundaries or field of what is acceptable and achievable in population management (Wang et al., 2019). Further, Rozak and Junaedi (2022) stated that central or subnational authorities can monitor closely-knit developments, such the expansion of swidden agriculture or the construction of new road infrastructure, by viewing and mapping activity at the local, even sub-hectare resolution. Plans for new plantations and conservation areas, as well as information on tenure, the limits of forest concessions, the locations of infrastructure and settlements, can all be useful in localized assessments.

The biopolitical component of REDD+ demonstrates how governmental efforts are concentrated on controlling forest mortality and promoting forest vitality via the enrichment of biological processes that sequester atmospheric carbon (Dirgantara, 2022). Programs addressing climate change, such as REDD+, are typically up against fierce competition from those who support and profit from forest growth, including local actors, government organizations, and private businesses that put tremendous pressure on producers to increase output. In addition,

several government agencies vie for control over how land is used and distributed, with the emphasis on employment and production goals sometimes surpassing those of conservation or carbon offset initiatives.

4.2. Identification and Implementation of Carbon Emission and Subsidiaries in Indonesia

Most recent projection, 14.01 million hectares of degraded land are expected to exist in 2018. Indonesia's efforts to reduce emissions from deforestation and forest degradation (REDD+) have also garnered recognition and appreciation on a global scale. The Government of Indonesia has received funds worth 103.8 million USD as performance payments through the Result Based Payment (RBP) scheme from the Green Climate Fund (GCF) (Andrian & Kevin, 2021). A jurisdictional REDD+ initiative in East Kalimantan, one of the provinces in Indonesia's Borneo, is anticipated to produce 86.3 MtCO2e between 2020 and 2024 under the Forest Carbon Partnership Facility (FCPF). Because extra sequestration from reforestation activities is not considered in any of these schemes, the potential net emission reductions are underestimated.

According to Basuki et al. (2022), in terms of emissions from deforestation, Indonesia has the third-highest yearly global greenhouse gas (GHG) emissions (after China and the United States). One of the main causes of greenhouse gas emissions in tropical forests is deforestation and forest degradation. It has long been known that the two most important things that can be done to stabilize the climate are to increase afforestation/reforestation and minimize deforestation. By 2055, afforestation and reforestation will absorb 0.1–2.6 $GtCO_2$ yr^{-1} globally, but avoiding deforestation might offset 0.3–1.8 $GtCO_2$ yr^{-1}.

In 2022, the World Bank supplied carbon money to East Kalimantan. These emissions are acquired in accordance with the economically evaluated outcomes of lowering carbon emissions. Reducing Emissions from Deforestation and Degradation of Forests and Peatlands (REDD+), is a program that offers incentive payments to poor nations that mitigate emissions from deforestation and degradation. These payments are known as carbon funds. The goal of carbon fund payments is to lessen the effects of climate change caused by deforestation and other forest loss. To ensure long-term sustainability, these money might be applied toward the costs of forest protection. Countries that successfully reduce their carbon emissions are rewarded with carbon emissions.

A deal to decrease carbon emissions in 2019 was reached through the World Bank because of this pledge (Cahyono et al., 2023). It is mandated that East Kalimantan preserve and restore its crops and forests, with the goal of cutting carbon emissions by 22 million between 2022 and 2025. East Kalimantan was able to surpass the goal in 2021, cutting emissions by 30 million carbon tons. Subsequently, the World Bank contributed USD 20.9 million, or 300 billion IDR, in carbon funds. Afterwards, the districts and/or cities will get the carbon emissions from the indigenous groups.

Most others will be administered by separate organizations. Villages and community organizations in East Kalimantan Province will receive funding designated for carbon incentives. For the emissions disbursed to be utilized and documented for emission reduction initiatives, the government has taken a few steps in preparation. With the help of the REDD+ initiative, the World Bank's FCPF-Carbon Fund performance-based payment program assesses how well East Kalimantan Province is doing at decreasing emissions. East Kalimantan is thought to be possible to cut emissions by 22 million tons of carbon dioxide equivalent (CO_2e) between 2019 and 2020.

The World Bank committed money of 110 million US dollars, or Rp 1.7 trillion (at the current exchange rate of Rp 15,700 per US dollar), to East Kalimantan for these services (Groom et al., 2022). A payment in advance of 20.9 million US dollars, or about Rp 329 billion, has been made by the World Bank. The governments at different levels—provincial, district/municipality, and village—and partner institutions must understand how to use FCPF emissions when they are allocated.

The Sustainable Development Goals (SDGs) pertaining to sustainable forest management include the FCPF-Carbon Fund initiative program. preservation of forest resources and initiatives to raise high carbon stocks (HCS) in forests (Yuliandhari & Ayustyara, 2023). As progress toward the realization of the utilization of FCPF-Carbon Fund is around 23% of the total amount received, which is IDR 6,827,728,400 (amount USD 420,945.16). The

following projects are part of the World Bank's appropriation directives include: (1) Management of biodiversity parks; (2) Capacity building; (3) Recognition of the customary law community in Muara Wahau; (4) Other related activities.

Consequently, preserving high carbon stocks and cutting carbon emissions may be achieved by concentrating on the upkeep or restoration of HCS regions (Evana & Lindrianasari, 2021). The Government has pledged to assist in lowering greenhouse gas emissions by issuing a directive pertaining to the creation of indicative area protection maps. As a result, the East Kutai Regency Government in East Kalimantan Province was selected as one of the pilot projects to execute the nine Regencies of Indonesia's Sustainable Jurisdiction Indicators.

4.3. Comparison to Brazil and Congo

While an average of 47% is recorded for the Congo Republic, 32% on average and 66% of the wood trafficked from the Congo Republic comes from illicit sources in the Congo Basin (Jiang et al., 2023). These nations likewise have low ratings for governance, as seen by scores of −1.1 and below for both corruption and governance effectiveness. Apart from Indonesia, which has an average of 46%, the other nations that produce timber have comparatively lower rates of timber traded at a high risk of being done so illegally; these nations also have higher governance ratings than those in the Congo Basin.

Any nation would find it strategically advantageous to have current, trustworthy data on the condition and future directions of its forests, as sound forestry statistics are necessary for enacting laws and attracting profitable investments. Furthermore, forestry data are required to direct the appropriate measures to fulfill the nation's international obligations, especially about the hotly contested subject of climate change. Brazil's contribution to the global forest economy is still rather small (Mudiyarso et al., 2018).

One of the possible causes might be the long-term inconsistency and poor quality of Brazil's forest data relative to the forestry profile. Throughout the course of 26 years, the dynamics of the total carbon supplied in Brazilian forest plantations and HWP equate to the removal of 1.7 Gt CO2-eq (Assis et al., 2020). Of this removal, 84% (1.4 Gt) came from removals by forest stands because of increased planted area and stand productivities, and 16% (270 Mt) came from the wood product sink (Heinrich et al., 2021). The Amazon forest is the greatest biosphere in Brazil for naturally absorbing carbon, but during the past 30 years, it has witnessed a net loss when paired with emissions from land development (Richards et al., 2017).

Although there is still a significant natural sink, ecosystem resilience is deteriorating due to both local and global climate change brought on by increased emissions from worldwide travel and altered circulation patterns brought on by local deforestation and degradation. These factors together make it more difficult to realize the enormous potential for carbon reduction. It is still clear that the greatest approach to minimize emissions and lessen the effects of climate change is to maintain forests and prevent their deterioration and disturbance.

Brazilians signed the CoP26 Leaders' Declaration (2021) on Forests and Land Use, pledging to "work collectively to halt and reverse forest loss and land degradation by 2030," reaffirming their commitment to forest protection (INPE, 2021). The land-use sector is the focus of this study, which also highlights the significance of the natural, undisturbed carbon sink, the difficulties and uncertainties in measuring Brazil's historical land-use emissions and removals, and their role in meeting the country's climate mitigation objectives (Wiltshire et al., 2022).

Regrowth is limited because the regrowth sink vanishes after trees have restored a balance between growth and carbon loss from disturbance. Regrowth sinks reverse prior deforestation by offsetting emissions from previous disturbances to the forest, but only if the initial biomass is reached. After 60 years, the rate of carbon removal can reach 90% of the final biomass, which is 11 times faster than the rate of development of old age intact forests. In addition to being Brazil's largest carbon sink, the Amazon ecosystem has seen the greatest emissions from changing land use in recent years. By decreasing land-use emissions and enhancing removals, Brazil has achieved significant reductions in emissions.

4.4. Impact of Carbon Reductions in Terms of Land Ownership, Politics and Policies, and Institutions in Indonesia

The analyses above show how the different nations would be impacted by carbon reductions in terms of land ownership, politics and policies, and institutions. Furthermore, its practical and policy insights can be useful when examining other nations' emission reduction plans for REDD+ and NDCs. Nevertheless, we do not assert that the results are readily applicable to other contexts. Reduced generalizability the degree to which that is feasible is, in any event, debatable seems like a fair price to pay for gaining a deeper comprehension of a particularly important country with forests.

The Indonesian National Development Planning Agency in 2019 stated that the nation ranks fourth in terms of overall emissions behind China, the United States, and India due to the frequent and severe fires that Indonesia experienced (Rozak & Junaedi, 2022). Therefore, Indonesia's ability to accomplish the emission reductions promised in its NDC can be achieved only through its success in decreasing deforestation, forest degradation, and fires, particularly those that harm peatlands.

Indonesian Government has been working on developing the administrative and regulatory framework for REDD+ implementation over the last 10 years, and this effort is now included in the country's NDC (Andrian & Kevin, 2021). With emissions from forests and peat fires rising from 505.3 MtCO2e in 2000 to 979.4 MtCO2e in 2014, Indonesia's total emissions of greenhouse gases grew from 1000.4 MtCO2e in 2000 to 1844.3 Mt CO2e in 2014 (Tacconi & Muttaqin, 2019). By 2030, Indonesia aims to reduce its carbon footprint by 29% unconditionally and up to 41% conditionally relative to the business-as-usual scenario (Yuliandhari & Ayustyara, 2023).

The expected rise in emissions from energy production by nearly four times accounts for the much lower contribution of emissions from forestry by 2030. The forestry industry is tasked with reducing emissions by 497 MtCO2e by 2030, which is an unconditional objective. To reach the 38% overall emissions reduction objective, conditional reductions of 9% versus business as usual will also be achieved, with an additional 153 MtCO2e allocated to forestry. These objectives suggest that the forestry industry will cut its emissions by about 69.6% unconditionally and an additional 21.4% with conditional external help from REDD+ (Basuki et al., 2022).

Consequently, by 2030, there will be a 91% decrease in emissions overall compared to business as usual, which the facts may indicate that even greater effort is being made to meet the 2030 total emissions reduction objective (Dirgantara, 2022). This is because emissions seem to be rising significantly faster than the 3.9% average between 2010 and 2030 that is predicted. This assumes that annual growth in forestry emissions will be 0.5%, It is estimated that between 2021 and 2030, 0.82 million hectares of forest will be lost annually (Evana & Lindrianasari, 2021).

The following analysis of forestry sector and other sectors' policies is necessary for a complete strategy to decrease emissions, to make sure that all policies either support or do not contradict the overall objective of reducing emissions. Indonesia's land allocation policy has been characterized by a lack of institutional clarity, inconsistent rules, and inadequate coordination. They also emphasized that there may have been a chance to lower emissions from deforestation if there had been a ban on new logging concessions, which had been instituted not long before they completed their research.

In East Kalimantan province, green growth aspirations at the provincial level revealed a conflict between local intentions to increase oil palm farms and government initiatives to cut emissions. They concluded that the primary obstacles to resolving these tensions stemmed from a political economy that was unfavourable to changes in the land-based sector and from the poor coordination between various governmental levels. The thorough examination of REDD+ related laws, rules, and policies at the municipal and federal levels, together with the preparedness for their implementation.

5. Conclusion and Implication

The findings and discussion highlight the intricate relationship between carbon emission disclosure and the biopolitical framework that governs environmental management strategies. The application of biopolitics in

managing carbon emissions involves the systematic quantification and control of biological activities, emphasizing the role of governmental and non-governmental actors in transforming natural landscapes into regulated carbon domains. This approach is particularly evident in the implementation of REDD+ initiatives in Indonesia, Brazil, and Congo, where data-intensive mapping and modeling techniques are employed to monitor and manage forested areas for carbon credits.

In Indonesia, the integration of REDD+ within national policies has led to significant advancements in reducing emissions from deforestation and forest degradation. The financial incentives provided by global funds, such as the Green Climate Fund and the World Bank's Forest Carbon Partnership Facility, have facilitated the development of sustainable forest management practices. However, the success of these initiatives hinges on the effective coordination among various governmental levels and the alignment of local and national policies towards emission reduction goals.

Comparatively, Brazil and Congo face unique challenges in their efforts to manage forest carbon. Brazil's vast Amazon rainforest plays a crucial role as a carbon sink, but deforestation and land-use changes pose significant threats to its capacity for carbon sequestration. Similarly, Congo's governance issues and high rates of illegal timber trade complicate the implementation of effective carbon reduction strategies.

Overall, the study underscores the importance of robust institutional frameworks, clear land-use policies, and comprehensive governance to achieve sustainable carbon emission reductions. The biopolitical approach to environmental management, exemplified by REDD+ initiatives, provides a critical lens through which the complex dynamics of power, knowledge, and environmental governance can be understood and addressed. By leveraging biopolitical strategies, countries can better navigate the challenges of climate change mitigation and foster sustainable development in forested regions.

Based on the identification and implementation of carbon emission disclosures and subsidiaries in Indonesia in comparison to Brazil and Congo, the following changes should be made to the reforestation fund distribution formula: (i) Disincentives should be substituted for incentives for districts and regionals from central government to produce or harvest more timber; (ii) Fees for mining in state forests should be raised in order to fully cover the costs of reclamation and rehabilitation of mined areas; (iii) The technical specifications for underground mining in protection forests should be tightened in order to restrict the amount of mining permits that local governments can issue.

The changes offer a thorough examination of the several levies and assessments that the government must consider to encourage sustainable forest management. Additionally, they emphasize that the government ought to think about offering incentives to companies that provide carbon trades and environmental services to refrain from exploiting forests. These might be in the form of public-private partnerships, corporate investments, or involvement from civil society in forestry and land use reform. They can also include incentives like payment for ecosystem services or restoration of the forest ecosystem.

Considering these findings, it is noteworthy to mention a recent encouraging development. Although the jurisdictional approach to REDD+ was taken into consideration in the research, its applicability is wider since a national government may employ a jurisdictional method to meet its objective for unconditional emission reductions. They examined the primary land use-related initiatives occurring at the province, district, and village levels and suggested including all three of these governmental levels in the REDD+ implementation process. However, because of the size of the lands and the possibility of reducing emissions, the village level implementation should be coordinated at the district level. The case study region has the potential to reduce emissions by as much as 15% compared to a business-as-usual scenario.

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