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Analysis of Carbon Trading Potential in Forest Conservation Areas as A Sustainability Strategy in PT Cheil Jedang Indonesia Pasuruan

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ABSTRACT

Carbon trading is a strategic mechanism to support sustainability in Indonesia by integrating economic, environmental and social considerations. This research explores the potential of carbon trading in the forest conservation area of PT Cheil Jedang Indonesia (CJI) Pasuruan as a sustainability strategy to maximize economic and ecological benefits. This research used a qualitative approach with data collection through observation and documentation. Primary data was obtained from stakeholders, while secondary data included reports, regulations and literature. Analysis was conducted by combining economic valuation and qualitative descriptive analysis. PT CJI Pasuruan demonstrated significant carbon trading potential through two conservation areas, namely Patuguran Mangrove and Puspo area, with an estimated economic value of carbon reaching IDR 4,147,929,778. In addition, the company is committed to reducing greenhouse gas emissions and supporting sustainable forest management practices. The results indicate that carbon trading can contribute to economic, environmental and social sustainability. Despite challenges such as regulatory complexity, this initiative can serve as a model for other companies looking to implement sustainability-based strategies.

Keywords: PT CJI Pasuruan, potential, carbon trading, economic valuation, carbon pricing.

INTRODUCTION

Climate change has become one of the most pressing global challenges, characterized by rising global temperatures, extreme weather conditions and significant ecological impacts (Ghil & Lucarini, 2020; Gössling et al., 2023; Hales, 2019). Greenhouse Gases (GHGs), especially carbon dioxide (CO_2), are major contributors to climate change due to human activities such as fossil fuel combustion, deforestation, and industrialization. The researchers argue that the impacts of climate change not only damage the environment but also affect the global economy, with losses reaching billions of dollars per year due to climate-induced natural disasters (Formetta & Feyen, 2019). Amidst these challenges, climate change mitigation has become a top priority for many countries, including Indonesia, which plays an important role in global efforts through the management of its biodiversity-rich tropical forests. One of the most effective instruments for climate change mitigation is supporting carbon trading initiatives.

Carbon trading is a market-based mechanism within the value framework of the carbon economy, designed to reduce Greenhouse Gas (GHG) emissions through the purchase and sale of carbon credits (MJ et al., 2023). The instrument functions by allowing entities that successfully reduce their emissions below a set limit to sell their

excess allowances to others. There are two main carbon trading mechanisms: cap-and-trade and offsets. According to researchers, cap-and-trade systems set an upper limit on emissions for each entity, allowing those with emissions below the threshold to sell their surplus quota to those in need (UU Republik Indonesia et al., 2022). Meanwhile, offset mechanisms provide carbon credits to parties engaged in carbon sequestration activities, such as reforestation or forest conservation, which can then be traded on the carbon market (Cetera, 2022; UU Republik Indonesia et al., 2022).

As one of the largest tropical forest countries in the world, Indonesia plays a strategic role in mitigating climate change through sustainable natural resource management (Abram et al., 2021; He et al., 2021; Miller & Hutchins, 2017). To support these efforts, the government has issued various regulations, including Presidential Regulation No. 98 of 2021 concerning the Application of Carbon Economic Value, which serves as the legal basis for carbon trading (Presidential Regulation of the Republic of Indonesia No. 98, 2021). This regulation aims to support the country's commitment to reduce greenhouse gas emissions in line with Indonesia's Nationally Determined Contribution (NDC) targets. In addition, it promotes the utilization of tropical forests as strategic assets in carbon trading schemes, either through conservation-based emission reductions or enhanced carbon sequestration (França et al., 2020; Scerri et al., 2022). This initiative was further strengthened with the launch of Indonesia IDX Carbon, which establishes a formal market mechanism for carbon credit trading at the national level.

Forests play an important role in climate change mitigation due to their ability to absorb carbon dioxide through photosynthesis (Saatchi et al., 2021; Slik et al., 2018). This function positions forests as strategic assets in carbon offset schemes, where carbon credits can be generated from conservation activities and sustainable forest management. These credits can then be traded on carbon markets, providing both economic incentives and environmental protection (Cetera, 2022; UU Republik Indonesia et al., 2022). Carbon credits resulting from carbon trading can be recognized as intangible assets in financial statements, in line with accounting principles. Jayachandran (2025) classifies carbon into assets based on the economic benefits it produces, even though it has no physical form. Carbon credits have economic value that can be utilized in the future by companies (Ikatan Akuntan Indonesia, 2024). This concept is in line with the perspective of Environmental Economics, which emphasizes that economic value can be given to conservation efforts and emission reductions aimed at encouraging sustainable practices (Kwilinski et al., 2023). By applying environmental economics principles, carbon trading in the forestry sector can be an innovative solution in internalizing environmental impacts into economic decisions, thereby creating a balance between economic development and ecological sustainability.

Despite the potential for carbon trading through conservation areas in Indonesia, there is limited research specifically analyzing its implementation at the local level. Most studies focus on general carbon trading mechanisms or global forest management without exploring the specific opportunities and challenges of particular conservation areas (Mentari et al., 2024). In addition, there are gaps in the implementation of carbon trading

policies, particularly regarding inter-agency coordination, monitoring and oversight at the national level (Chusi et al., 2024). Further research is needed to identify the economic and environmental benefits of conservation-based carbon trading while serving as a guideline for more effective implementation strategies in other regions with similar characteristics.

The potential of carbon trading does not only apply at the national scale but can also be implemented at the corporate level, as demonstrated by the conservation area of PT Cheil Jedang Indonesia (CJI) Pasuruan. This area plays a role in supporting carbon trading schemes through offset and cap-and-trade mechanisms. Given its size and ecosystem characteristics, it has the capacity to serve as a significant carbon sink while preserving existing biodiversity. Research has shown that the carbon potential of conservation areas in Indonesia, such as the Katingan Mentaya Project, has resulted in positive environmental and economic impacts (Sukadi et al., 2020). Furthermore, sustainable management of conservation areas can support national emission reduction targets and create new economic value through carbon trading (Samasta, 2023). Based on these perspectives, it can be concluded that the PT CJI Pasuruan conservation area is not only ecologically relevant but also strategically important in supporting national climate change mitigation policies.

This research aims to analyze the potential for carbon trading in the forest conservation area of PT Cheil Jedang Indonesia Pasuruan, with a focus on exploring the applicable carbon trading mechanisms and their impacts on environmental and economic sustainability. The findings of this research are expected to contribute significantly to understanding how conservation areas can play an important role in climate change mitigation. By deepening the analysis, this research also aims to serve as a strategic reference for improving the effectiveness of carbon trading implementation in other conservation areas with similar characteristics.

RESEARCH METHOD

This research used a qualitative approach to explore the potential for carbon trading in PT CJI Pasuruan's forest conservation area as a sustainability strategy, covering regulatory, technical, environmental and economic aspects. The researcher played a direct role in data collection and analysis through observation, and documentation, ensuring a deep understanding of the social, economic, and environmental context. The study utilized primary data obtained directly from stakeholders, and secondary data, including reports, regulations, and literature. Data collection methods included field observations of conservation conditions, and emissions monitoring, as well as documentation of sustainability reports, carbon inventories, and policies. In addition, the interviews are not structured flexibly without a standard list of questions, thus providing space for respondents to convey their perspectives more naturally and openly Respondents interviewed include the ESG team and the Environment team.The analysis combines economic valuation-estimating carbon stocks and their monetary value using the formula NEK = SC02 × Rp-and qualitative descriptive analysis, which follows data reduction,

presentation, and verification. This approach provides holistic insights into the potential, challenges and long-term implications of carbon trading, taking into account regulatory, economic and environmental factors for sustainable forest management.

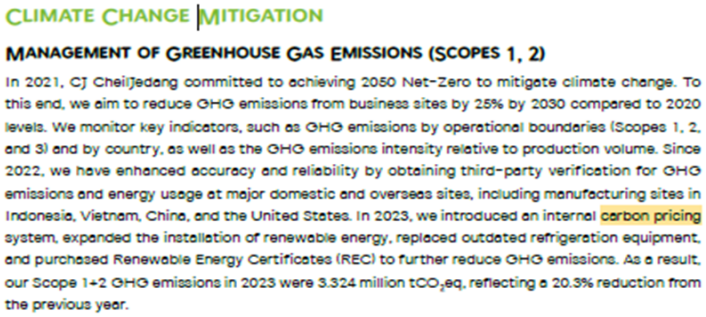
RESULTS AND DISCUSSION

PT Cheil Jedang Indonesia (CJI) Pasuruan, a subsidiary of CJ Corporation of South Korea, has been operating in Indonesia since 1988, focusing on food, animal feed, pharmaceutical, and biotechnology production. Committed to sustainability, CJI integrates environmentally friendly practices into its operations and maintains internal and external conservation areas. Through annual field monitoring, the company ensures effective conservation efforts that benefit biodiversity and surrounding communities. PT CJI Pasuruan manages two conservation areas: Internal Areas, which focus on sustainable environmental management within the company, and External Areas, which involve community collaboration for forest conservation and ecosystem restoration. Based on the results of research on forest conservation areas at PT CJI Pasuruan. It was found that there are factors that lead to carbon trading in forest conservation areas. The following is a description of the supporting and inhibiting factors towards carbon trading in Forest Conservation Area.:

Table 1. PT CJI Pasuruan conservation area

No.	Conservation Area	Coordinate Point	Area
Company External			
1	Patuguran Mangrove Coastal Area	7°37'27.37°S ; 112° 57'29.54" E	3.8 Ha
2	Puspo catchment area: - Gondosuli - Palangsari	7°50'31.35°S ; 112° 52'02.93" E	2.6 Ha
Company Internal			0,85 Ha
	Total Conservation Area		7.25 Ha

PT CJI is committed to environmental conservation and carbon emission reduction through its conservation areas, supporting global climate mitigation efforts while fostering positive community relations. Six months of observation and documentation in PT CJI Pasuruan's forest conservation area revealed strong carbon trading potential. The company's commitment to reducing greenhouse gas emissions through Carbon Pricing supports this initiative, aligning with its sustainability strategy and market-based carbon trading opportunities.


CLIMATE CHANGE MITIGATION

MANAGEMENT OF GREENHOUSE GAS EMISSIONS (SCOPES 1, 2)

In 2021, CJ CheilJedang committed to achieving 2050 Net-Zero to mitigate climate change. To this end, we aim to reduce GHG emissions from business sites by 25% by 2030 compared to 2020 levels. We monitor key indicators, such as GHG emissions by operational boundaries (Scopes 1, 2, and 3) and by country, as well as the GHG emissions intensity relative to production volume. Since 2022, we have enhanced accuracy and reliability by obtaining third-party verification for GHG emissions and energy usage at major domestic and overseas sites, including manufacturing sites in Indonesia, Vietnam, China, and the United States. In 2023, we introduced an internal carbon pricing system, expanded the installation of renewable energy, replaced outdated refrigeration equipment, and purchased Renewable Energy Certificates (REC) to further reduce GHG emissions. As a result, our Scope 1+2 GHG emissions in 2023 were 3.324 million tCO_2eq, reflecting a 20.3% reduction from the previous year.

Figure 1. GHG Management

Regular recording of greenhouse gas emissions enables carbon footprint monitoring and ensures transparent environmental reporting. PT CJI Pasuruan reports emissions not only in its Sustainability Report but also on the official SIMPEL Electronic website under the Ministry of Environment and Forestry.

GHG EMISSIONS Unit: 1,000 tCO_2eq

INDICATOR	2021	2022	2023	2030 TARGET*
Scope 1	2,877	2,823	2,196	25% reduction (compared to 2020 levels)
Scope 2	1,518	1,345	1,129	
Scope 3	10,303	10,286	9,528	-
Total	14,698	14,454	12,853	-

* The 2030 targets apply only to domestic sites in the Food Business Unit and to sites in the BIO Business Unit.

Figure 2. CJ Greenhouse Gas Emissions Data

PT CJI Pasuruan is registered with the National Registry System for Climate Change Control (SRN-PPI), a government-managed platform for recording climate mitigation actions, including carbon emissions measurement, reporting, and verification (MRV). This registration enables participation in carbon trading, with future potential to expand into the forestry sector by utilizing conservation areas to generate carbon credits.

Figure 3. SRN-PPI Registration Number

The conservation areas around PT CJI Pasuruan are well maintained, with healthy ecosystems and biodiversity. The Patuguruan Mangrove Conservation Area spans 3.8 hectares at coordinates 7°37'27.37 "S; 112°57'29.54 "E, located 8.4 km from the company.

Figure 4. Location Map of Mangrove Conservation Area

Figure 5. Environmental Conditions of Mangrove Conservation Area

The image above is a snapshot of the well-maintained environmental conditions ,with thriving mangrove vegetation. It is evidenced by the diversity of mangrove species in an area with a total of 166 individuals and an average diameter at Breast Height (DBH) of 17.96 cm, as follows. The existence of these trees plays an important role in absorbing carbon from the atmosphere, which contributes to cleaner air quality and supports the balance of ecosystems. This diversity of flora also supports the life of various fauna in the Patuguruan mangrove area, forming a dynamic and sustainable ecosystem. This is evidenced by the discovery of 33 species of fauna and dominated by swallows, rice paddies and small egrets. The Patuguruan mangrove conservation area also has clear water, reflecting the maintained environmental conditions. This clarity can be seen from the large number of crabs that make the mangrove ecosystem their natural habitat. Crabs are organisms that are sensitive to environmental changes, crabs can only breed and forage in clean waters. The presence of crabs is an indicator of good water quality. In addition, the discovery of various organisms such as phytoplankton as many as 350 individuals and zooplankton as many as 42 individuals.

Puspo Conservation Area covers 2.6 hectares at coordinates 7°37'27.37 "S; 112°57'29.54 "E, located 30.3 km from PT CJI Pasuruan. The area is well preserved, demonstrated by the fresh air quality and clear ambient water with healthy vegetation that has a large diameter and minimal damage.

Figure 6. Location Map of Puspo Conservation Area

Figure 7. Environmental conditions in Puspo Conservation Area

This is evidenced by the presence of flora that grows in the area. It was found that 92 flora individuals with an average Diameter at Breast Height (DBH) of 24.59 cm were found in the gondosuli area and dominated by Durio zibethinus (durian), while in Palangsari there were 19 individuals with an average DBH of 17.42 cm. and dominated by Ochroma grandiflorum (balsa) with 3 individuals. This diversity of flora shows that the ecosystems in both regions are still preserved, which contributes to air quality and environmental balance, and supports the existence of fauna. The discovery of the diversity of bird species at two points of the location of the puspo conservation area, namely Gondosuli and Palangsari. In Gondosuli, 143 individuals of birds of various species were

recorded, while in Palangsari there were 56 individuals. Both points are dominated by Collocalia linchi with 64 individuals in Gondosuli and 31 individuals in Palangsari.

PT CJI Pasuruan annually calculates carbon sequestration and stocks in the mangrove conservation area. Since 2022, the well-maintained condition of the Patuguran Mangrove area has contributed to an increase in carbon sequestration and stocks, reflecting sustainable conservation efforts.

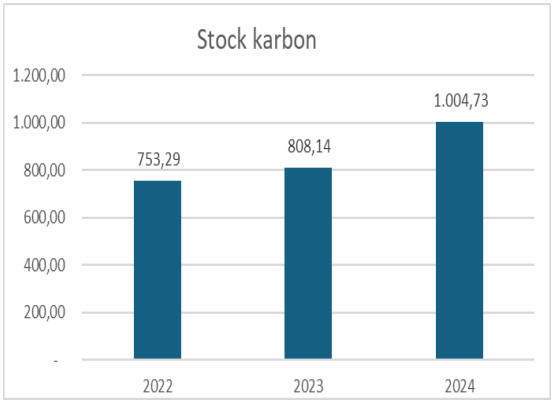


Figure 8. Carbon stocks in mangrove conservation areas

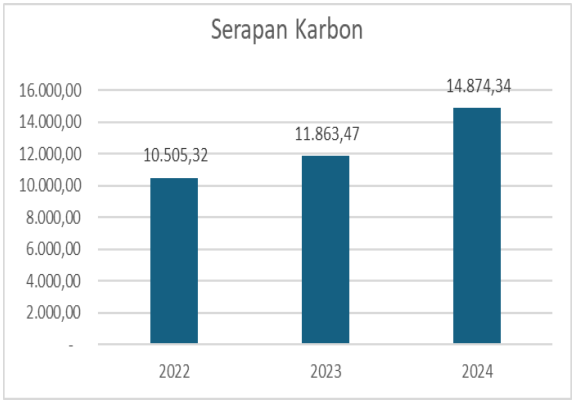


Figure 9. Carbon Sequestration in Patuguran Mangrove Area

The diagram shows a significant increase in carbon stock and sequestration capacity in the mangrove conservation area, demonstrating effective management. Continued ecosystem maintenance, including regular maintenance and monitoring, has increased carbon sequestration, contributing to climate change mitigation efforts.

The well-maintained environment in the Puspo area reflects sustainable conservation efforts, which directly increases carbon sequestration and stocking capacity. Carbon stock and sequestration measurements were made in 2024, with details as follows:

Table 2. Estimated Carbon Sequestration and Carbon Stocks

Conservation Area	Carbon Stock	Carbon Sequestration
Gondosuli	102.573	376.102
Palangasari	3.156	14.180
Total	52.864	448.825

Puspo conservation area has a higher carbon sequestration and storage capacity than other areas, due to its large diameter. Both conservation areas are an important part of PT CJI Pasuruan's sustainability strategy, supporting the SDGs on climate action, ecosystem conservation and forest carbon trading. The calculation of the 2024 carbon sequestration by PT CJI Pasuruan has been valued in Rupiah based on the Carbon BEI, which determines the Economic Value of Carbon.

Table 3. Estimated Economic Value of Carbon

Conservation Area	Stock Carbon	Rates	Est. Economic Value Of Carbon
Puspo	52.864	IDR 77,000	IDR 4,070,565,660
Mangroves	1004,7	IDR 77,000	IDR 77,364,117
Total Estimation Economic Value Of Carbon			IDR 4,147,929,778

PT CJI Pasuruan has significant carbon sequestration potential, which can be converted into carbon credits for trading under applicable regulations. Despite its potential, carbon trading at PT CJI Pasuruan faces challenges, including : the absence of a PBPH license. Based on Peraturan Menteri Lingkungan Hidup dan Kehutanan No. 7 Tahun 2023, Every company that will carry out carbon trading must have PBPH (Perizinan Berusaha Pemanfaatan Hutan). PBPH is a permit granted to business entities or individuals to use forest areas legally and sustainably. This is because carbon is one of the products of forest ecosystems, which is absorbed and stored in tree and soil biomass. With PBPH, companies can ensure that carbon utilization and trading activities are carried out in accordance with sustainability principles.

Carbon trading process complexity, A statement by the ESG team that it takes the company 4 years to achieve the Stage 4 process in the energy sector's carbon trading. This shows that this process takes a long and gradual time. Stage 4 in carbon trading generally refers to the verification phase in an already-running carbon trading scheme. This is also relevant to carbon trading in the forest sector, which faces similar challenges in terms of regulation, certification, and recognition of carbon credits. Looking at the experience in the energy sector, it can be concluded that forest carbon trading also requires long-term commitment and readiness in terms of environmental monitoring, carbon sequestration calculations, and compliance with applicable regulations. Nonetheless, the economic potential that can be generated from forest carbon trading remains huge, especially if existing barriers can be overcome with the right strategies.

Based on the description above, PT CJI Pasuruan has the opportunity to make carbon trading a sustainability strategy by utilizing conservation areas to generate carbon credits. This is in line with environmental economic theory, carbon emissions are a negative impact that triggers climate change (Kabir et al., 2023). With a carbon trading system, companies that produce emissions have to pay extra fees for carbon credits. while companies that can reduce emissions will get financial benefits (Nastiti & Hardiningsih, 2022). This proves that PT CJI Pasuruan has the potential to trade carbon with carbon offset mechanisms through its forest conservation area.

Carbon trading in the forest sector contributes to efforts to reduce carbon emissions because trees in forests play an important role as natural carbon sinks capable of absorbing greenhouse gases (GHGs) significantly through photosynthesis. In this case, PT CJI Pasuruan with its forest conservation area has the potential to support this effort.

PT CJI has done Proper conservation management, including regular monitoring of greenhouse gas emissions and calculation of carbon sequestration and stock (Mustikaningrum & Rosida, 2023; Kennedy, 2024), enhances the company's ability to generate tradable carbon credits. Furthermore, carbon from conservation activities is classified as an intangible asset, supported by official certification through the National Registry System (Mookdee & Bellamy, 2020; Mentari et al., 2024), with an estimated carbon economic value of IDR 4,147,929,778. As an intangible asset, this value illustrates the financial potential of conservation efforts in supporting the company's

sustainable business strategy. When optimized, it can be a carbon credit. Despite the challenges of accounting standards, the financial potential of conservation remains very promising.

PT CJI Pasuruan has integrated carbon trading into its corporate sustainability strategy. This commitment supports the achievement of the Sustainable Development Goals (SDGs) through more efficient emissions management (Easter Ceria et al., 2023). By utilizing the carbon trading mechanism, the company strengthens its operational sustainability while contributing to climate change mitigation, biodiversity conservation, and the enhancement of social and economic welfare for surrounding communities.

From the environmental perspective, carbon trading promotes SDGs 13 climate change mitigation, SDGs 14 (Ocean Ecosystem) and SDG 15 (Mainland Ecosystem) aim to protect ecosystems and prevent biodiversity loss and sdgs 6 the improvement of air and water quality (Sukadi et al., 2020; Nur Hidayah et al., 2023). Economically, carbon trading creates new market opportunities, drives green investment, and generates sustainable employment, as demonstrated by the conservation area's significant carbon economic value (Falson & Afrisca, 2023; Hidayah & Hamidy, 2020; Arifin Husein et al., 2023). This is in line with SDGs 8 decent jobs and economic growth and SDGs 9 Industry, innovation, infrastructure. Socially, carbon trading empowers local communities through economic incentives. It contributes to SDGs 1 (No Poverty) and SDGs 8 (Decent Work and Economic Growth) focused on poverty reduction and improving economic well-being, protects indigenous rights align with SDG 10 (Reduced Inequalities), which emphasizes the need to reduce social and economic disparities, especially for Indigenous peoples. In addition, sustainable forests help maintain better environmental quality, which positively impacts public health. This relates to SDG 3 (Good Health and Well-being), as it improves public health and welfare (Kennedy, 2024; Easter Ceria et al., 2023).

CONCLUSIONS

The carbon trading potential at PT CJI Pasuruan supports sustainability across economic, environmental and governance aspects. The company conducts annual carbon sequestration calculations, maintains SRN accounts, and manages forest and mangrove conservation. Carbon trading offers additional revenue, ensures regulatory compliance, and aligns with the SDGs, reinforcing PT CJI Pasuruan's commitment to social and environmental responsibility.

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