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RESEARCH

Community Investment in Clean Air: Preventing Respiratory Diseases Through Carbon Taxes and Environmental Awareness

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ABSTRACT

PURPOSE: This conceptual paper proposes a framework that views clean air as a social investment between the government and the community, where the carbon tax functions as a fiscal instrument for community involvement in emission reduction and where environmental awareness encourages behavioural change towards a sustainable lifestyle.

DESIGN/METHODOLOGY/APPROACH: This study adopts a conceptual approach, developing a framework based on a critical literature review and theoretical analysis using social investment theory and psychological ownership theory.

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FINDINGS: The current mechanism's impact on urban air quality remains limited because the transportation sector, a major source of daily emissions, is not yet included, and public environmental awareness remains low.

ORIGINALITY/VALUE: This study conceptually extends carbon taxation beyond industrial emitters to the transportation sector, highlighting its potential to enhance air quality, public health, and community participation in clean-air social investment.

KEYWORDS: *Carbon Tax; Clean Air; Transportation; Community Investment; Environmental Awareness; Respiratory Health.*

INTRODUCTION

Air quality in urban areas has become crucial along with the growing discourse on sustainable development. This issue is part of the complexity of urban life, together with population mobility, infrastructure development, and rapid economic growth (Kumar *et al.*, 2019; Piracha and Chaudhary, 2022). In many global standards, air quality is an indicator of urban well-being. In addition, urban air quality is often used as a benchmark for determining the extent to which cities can balance development needs with environmental sustainability. Air quality is usually measured by the amount of harmful pollutants produced by human activities, such as carbon monoxide (CO), sulphur dioxide (SO2), fine particulate matter (PM2.5), and ground-level ozone (O3), which can interfere with public health (Gallagher and Holloway, 2020).

In Indonesia, air quality in many cities shows alarming levels of pollution, especially in terms of fine particulate matter (PM2.5) concentrations, which consistently exceed national quality standards and World Health Organisation guidelines. Based on the Assessment of Urban Air Quality in Indonesia, the annual average PM2.5 concentrations in Jakarta, as a capital city, reached around 42.5 µg/m³, far above the national threshold of 15 µg/m³ (Haryanto *et al.*, 2025). In addition, cities near sources of land fires, such as Pekanbaru and Palangka Raya, experienced daily PM2.5 concentrations far above 65 µg/m³ during the haze season (Santoso *et al.*, 2020). Another study in Bandung showed a significant difference between industrial and non-industrial areas, with industrial areas recording PM2.5 levels of around 46 µg/m³, more than double that of non-industrial areas (Sunardi *et al.*, 2024). Indonesia is also among the 10 largest greenhouse gas emitters in the world, increasing the importance of paying attention to this issue (Setiawan *et al.*, 2021).

Poor air quality has the potential to have a significant negative impact on public health, especially the risk of diseases related to respiratory disorders. According to the study conducted by Syuhada *et al.* (2023), air pollution in Indonesia, especially in

Jakarta, contributes to more than 10,000 premature deaths each year, mainly due to heart disease, stroke, and chronic respiratory disorders. Findings from the AQLI (2025) also show that long-term exposure to air pollution causes an average reduction of 1.3 years in the life expectancy of Indonesians. Several studies in Indonesia have documented the impact of air pollution on respiratory disorders. For example, in Greater Jakarta, there were 73,694 cases of pneumonia and 15,825 cases of asthma in children during the 2020-2022 period, with an average PM2.5 of around 42.5 µg/m³ (Haryanto *et al.*, 2025). Thus, the issue of urban air quality is not only an environmental issue, but also a public health and sustainable development issue that needs to be addressed urgently.

However, despite Indonesia's growing attention to air quality issues and environmental policies, existing approaches remain largely top-down and have not sufficiently encouraged active community participation (Lukman *et al.*, 2025). Although air pollution has been widely studied, the public is still often positioned as passive rather than active agents in addressing everyday emission sources. This limitation highlights the need for an alternative perspective that integrates community participation into environmental governance.

Therefore, this study offers a novel conceptual framework that views clean air as an object of social investment, with carbon taxes and environmental awareness as the main instruments of community participation, particularly through an extended focus beyond industrial actors to include everyday emission sources such as transportation. This effort is expected to be a solution where the community is actively involved in achieving clean air goals, which simultaneously increases environmental awareness. In addition, the carbon tax implementation scheme and its proposed extension are expected to contribute to the achievement of green economy goals.

LITERATURE REVIEW

Causes of Poor Air Quality in Urban Areas

The poor quality of urban air in Indonesia is the result of a combination of rapid urbanisation, increased use of fossil fuel-powered motor vehicles, and industrial area expansion without adequate emission controls (Amin *et al.*, 2024; Lukman *et al.*, 2025). The limited amount of green open space that serves as a natural filter also exacerbates air pollution (Priyanta and Zulkarnain, 2024). Major cities, such as Jakarta, Surabaya and Bandung, face high environmental pressure due to the imbalance between economic growth and ecological carrying capacity.

Sustainable Development and Environmental Policy Instrument

Poor air quality poses a particular challenge for Indonesia in achieving its sustainable development goals. As a long-term goal outlined in the 2025–2045 National Long-Term Development Plan (RPJPN), Indonesia needs to strike a balance between development concepts that can boost economic growth and those that are environmentally friendly, to preserve natural resources and ensure intergenerational equity. In this context, the green economy is a strategic approach that emphasises energy efficiency, emission reduction and the creation of environmentally friendly job opportunities (Ansah and Sorooshian, 2019). The implementation of a green economy in Indonesia is not only seen as a response to global issues such as climate change but also as a means of strengthening the competitiveness of the national economy based on sustainability.

One way to create a green economy is by implementing carbon tax policies that have been officially stipulated in Law No. 7 of 2021 concerning the harmonisation of Tax Regulations (HPP Law) and have been gradually implemented since April 2022. Carbon tax is a fiscal instrument imposed on greenhouse gas (GHG) emissions, especially carbon dioxide (CO2), generated from economic activities (Timilsina, 2022). Its main purpose is to provide a price signal for emissions so that businesses are encouraged to reduce their use of fossil fuels and switch to low-carbon technologies (Hájek *et al.*, 2019). Thus, the carbon tax not only serves as a source of state revenue but also as an environmental control tool that supports the transition to a green economy and sustainable development.

Community Involvement in Environmental Governance

Countries cannot rely solely on policies and technological innovation to achieve the principles of a green economy, but they require the active involvement of the community as key actors in social and environmental change (Batrancea *et al.*, 2021). Public participation plays an important role in building collective awareness, changing consumption patterns and encouraging the implementation of environmentally friendly practices in everyday life (Lindemann-Matthies *et al.*, 2021). According to participatory governance theory, the extent to which the community is involved in the planning, implementation and evaluation of environmental policies greatly influences the success of environmental policies (Baldwin, 2020). Thus, community involvement should not be positioned as merely a complement but as the main foundation that ensures the sustainability of green economy implementation (Batrancea *et al.*, 2021). The synergy between the government, the private sector and the community will create

a collaborative ecosystem that can ensure that the transformation towards a green economy in Indonesia does not stop at the level of discourse but is truly realised in real and sustainable practices (Costa and Matias, 2020; Munandar *et al.*, 2025).

A Comparative Analysis of Previous Studies

Air pollution is closely related to an increased risk of respiratory diseases in the Asia-Pacific region, and several government interventions have successfully reduced emissions through vehicle regulations and renewable energy subsidies. However, the involvement of the public in these efforts has received little attention (North *et al.*, 2019). Other studies highlight the complexity of clean air policies in terms of politics, communication and social justice, but the public is more often positioned as the object of policy (Winter and Le, 2020). In fact, community solidarity initiatives play an important role, even though they are often hampered by the top-down nature of policies, so they need to be transformed into a form of social investment that is in line with regional development (Ittefaq and Kamboh, 2024). In Indonesia, efforts have been made to control air quality, ranging from the development of green open spaces to implementing carbon taxation. However, the approach used remains top-down and has not encouraged collective awareness or real contributions to air pollution management (Lukman *et al.*, 2025).

Despite these contributions, existing studies have not sufficiently conceptualised clean air as a form of social investment that actively involves community participation through fiscal and behavioural mechanisms, particularly in the context of transportation-related emissions.

RESEARCH METHODOLOGY

Theoretical Background

This study adopts a conceptual research approach, building a framework based on a literature review and theoretical analysis. Based on the research gap described earlier, a framework that can explain the role of society not only as recipients of policy but also as active participants in maintaining air quality is needed. To that end, this study adapts SIT, which emphasises the importance of community and state involvement in instilling values, resources and social responsibility to achieve long-term prosperity (Hemerijck, 2017; Lai, 2019). This theory views social welfare as being formed not only through policy redistribution but also through joint investments that generate sustainable public benefits. In the environmental context, social investment can be

understood as a collective effort between the government and the community to maintain ecosystem sustainability and improve quality of life through concrete actions (Andriollo *et al.*, 2021; Wahyuni *et al.*, 2021). This study views clean air as a form of social investment, with the government enabling participation and the community acting as social investors through carbon taxes and environmental awareness, as fiscal and behavioural contributions that support emission reduction and sustainable living.

This concept is supported by psychological ownership theory developed by Pierce *et al.* (2001). This theory states that individuals develop a sense of attachment and ownership over outcomes when they are given meaningful responsibility or opportunities to contribute. In clean air policies, community involvement through carbon taxes and environmentally friendly behaviour fosters this sense of ownership towards collective goals, forming the basis of a collective social investment mechanism where public contributions and government policies mutually reinforce one another.

Proposed conceptual framework

This conceptual framework, as shown in Figure 1, illustrates that achieving clean air is the result of a co-produced shared investment between the government and the community. The government contributes through governmental social investment, which is realised through policy instruments such as carbon taxes, emission reduction strategies and green economy initiatives. Meanwhile, the community plays its part through fiscal participation, such as carbon tax payments, and behavioural participation, reflected in increased awareness and environmentally friendly daily actions. Although these two forms of investment run in parallel, government policy acts as an enabler that opens space for and provides direction for wider public engagement. The synergy between institutional and social efforts forms a collective social investment mechanism, where policy instruments, fiscal responsibility and public awareness reinforce one another, resulting in reduced emissions, improved air quality and health, and a stronger sustainable green economy. In the long term, this mechanism positions the community as an active partner in maintaining ecological welfare and urban sustainability.

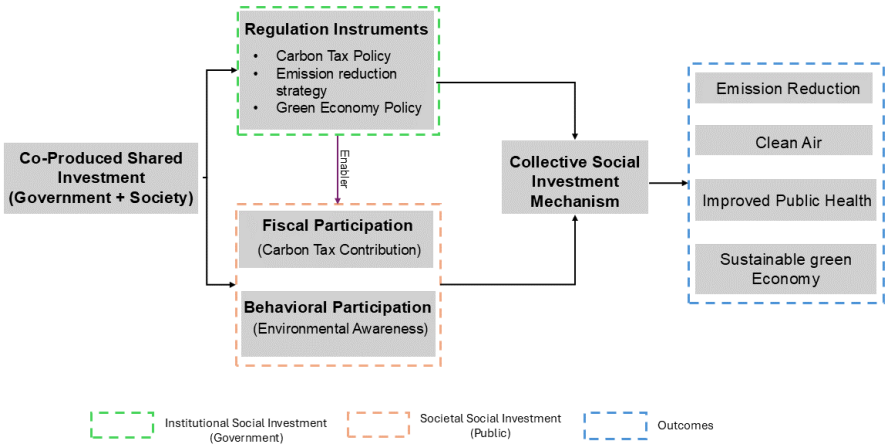

Figure 1: Conceptual Framework of Clean Air Social Investment

Source: Constructed by Authors

In practice, Indonesia's carbon taxation represents an important step towards a low-carbon economy. The Taxation Harmonisation Law gradually implements the policy using a cap-and-tax scheme focused on the energy sector and large industries, particularly coal-fired power plants. This mechanism promotes energy efficiency, clean technology adoption and environmental awareness through fiscal incentives and emission controls. Despite its limited coverage, it serves as a strategic foundation for the national carbon control system. This framework proposes extending carbon taxation to sectors that directly contribute to pollution, such as transportation, to enhance its impact on air quality and public health. This expansion is expected to increase environmental impact while also broadening public participation as social investors in maintaining clean air.

Ethical Statement

This study did not involve human participants, personal data or primary empirical research. All materials used in this analysis were derived from publicly available sources, and no ethical approval was required.

RESULT

Implications of Current Carbon Tax Policy

The implementation of carbon tax in Indonesia has focused on large industrial sectors, particularly coal-fired power plants and high-emission-intensity manufacturing sectors.

This policy serves as a fiscal instrument that encourages industry players to reduce carbon emissions through increased energy efficiency, the use of clean technology and a shift towards renewable energy sources. With a cap-and-tax mechanism implemented gradually, the government is seeking to create economic incentives to make emission reductions more profitable than maintaining carbon-intensive practices.

Indirectly, this policy provides co-benefits for air quality, as efficiency and energy transition efforts also reduce emissions of other air pollutants such as sulphur dioxide (SO2), nitrogen oxides (NOx) and fine particulates produced from coal combustion. However, these positive effects are more aggregated and long-term in nature, with the main impact being more related to global climate change mitigation than direct improvements in local air quality.

The Transportation Sector and Its Relationship with Urban Air Pollution

Under the current carbon tax conditions, immediate improvements in environmental air quality cannot be achieved. Expanding the sectors subject to carbon tax is necessary to simultaneously address climate and public health issues. This framework proposes a scheme to expand it to the transportation sector.

Based on an economic survey conducted by the Organisation for Economic Cooperation and Development (2024), the transportation sector is the second largest contributor to greenhouse gas emissions in Indonesia. This is because most vehicles in Indonesia still use fossil fuels as their energy source, and the burning of fossil fuels contributes to the production of greenhouse gases and local pollutants that are harmful to public health. This condition shows that the transportation sector must be seriously managed to support the achievement of healthy urban air quality and the realisation of a green economy.

Figure 2 shows the dynamics of the transportation sector, which shows the rate of private vehicle ownership in the form of passenger cars and motorcycles from 2015 to 2024. The graph shows that the number of private passenger cars and motorcycles tended to increase over the 10-year period. This was particularly true for motorcycles, which showed a fivefold higher ownership rate than cars and increased significantly to reach 139,593,112 units in 2024. This condition is expected to continue increasing every year, making the transportation sector one of the priority sectors in clean air management.

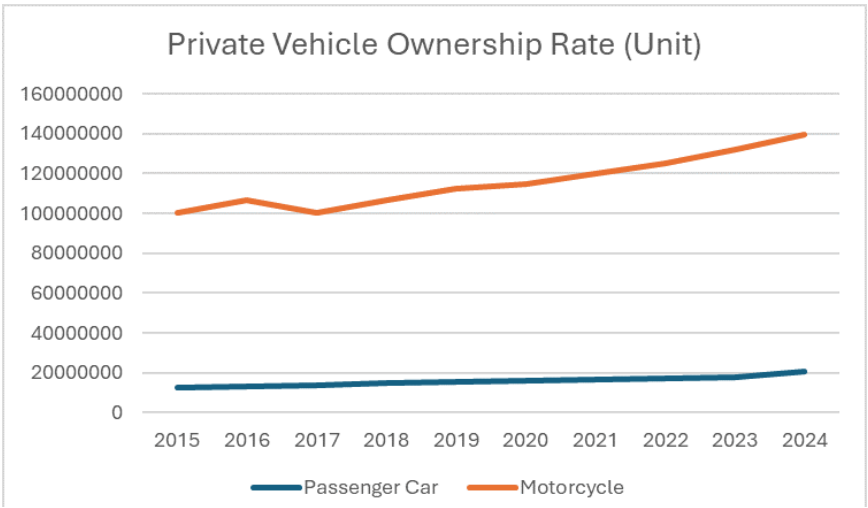

Figure 2: Private vehicle ownership rate in Indonesia

Source: Indonesia Ministry of Transportation (https://hubnet.kemenhub.go.id/dataset)

Furthermore, the transportation sector is a major source of local pollutants that directly affect air quality in urban areas. Figure 3 presents the air quality index in several major Indonesian cities with high levels of activity and mobility based on PM2.5 concentrations in October 2025. Jakarta, South Tangerang and Depok recorded unhealthy air quality levels, reflecting pollution concentrations in the Jakarta metropolitan area. Based on real-time data from IQAir, Jakarta is also frequently ranked among the cities with the worst air quality globally, highlighting the urgency of this issue.

Other cities, such as Bekasi, Bogor, Bandung and Semarang, have unhealthy air quality for sensitive groups, indicating that high levels of human activity significantly contribute to air pollution beyond the capital. Bandung's high congestion levels further emphasise the importance of considering the transportation sector. Meanwhile, cities such as Medan, Makassar and Surabaya currently show moderate air quality levels, but without comprehensive policy interventions, they may experience similar deterioration.

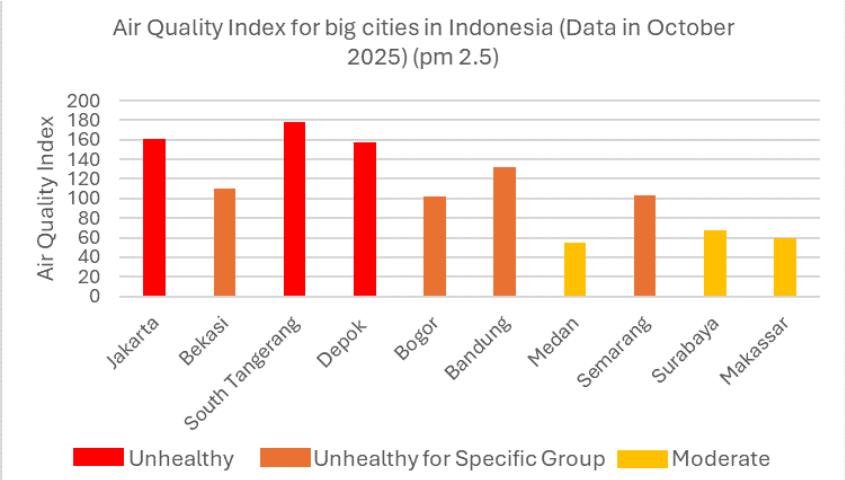

Figure 3: Air quality index for Indonesia's big cities in October 2025

Source: IQAir (https://www.iqair.com/id)

DISCUSSION

This discussion examines how air quality and public health can be achieved through synergy between government policy and active community participation, positioning society not only as a policy target but also as a key factor in policy implementation. This also explains why expanding the scope of carbon taxation is a strategic approach to improving public health while increasing environmental awareness. This study highlights a conceptual shift that links fiscal policy with social participation and behavioural change by extending carbon taxes beyond industrial sectors to everyday emission sources such as transportation. This framework is particularly relevant given Indonesia's persistently high levels of air pollution, especially in urban areas characterised by intense economic activity and mobility, which underscores the need for more inclusive and participatory emissions control policies.

Limitations of the Current Carbon Tax Policy in Addressing UAP

Although current policies promote energy efficiency in the industrial sector, they do not address the sources of air pollution that are closest to urban communities. While the industrial sector contributes significantly to national carbon emissions, major sources of urban air pollutants, such as land transportation, household activities and open burning, remain outside the scope of the current carbon tax mechanism. Consequently, the effectiveness of carbon taxes in improving air quality and reducing respiratory

health risks remains limited. Although the government has implemented carbon tax policies as fiscal instruments to control emissions in industrial and energy sectors, the transportation sector has not been included, causing the benefits to remain partial and disconnected from everyday pollution sources.

This limitation becomes more evident with the increasing number of vehicles in urban areas. The growth of private vehicles reflects high individual mobility and dependence on private transportation, especially in large cities. In response, the government has introduced policies such as vehicle emission testing, odd-even systems and incentives for EVs. However, these measures have not been effective in reducing vehicle numbers, as they do not sufficiently impose binding mechanisms on community participation. Controlling vehicle ownership remains a key challenge in addressing urban emissions.

Pressure on air quality continues to increase in line with these conditions, as reflected in declining air quality indices in many urban areas. The persistence of high mobility patterns and reliance on private vehicles indicates that the current policy instruments are insufficient to curb pollution at its source. Given these conditions, the expansion of carbon taxes to the transportation sector should be seriously considered due to its direct impact on public well-being. Based on the proposed framework, extending carbon taxes to the vehicle sector is expected to provide a more effective approach to emission control and address pollution sources most directly experienced by urban communities.

Low Community Environmental Awareness

The growing ownership of private vehicles in urban areas reflects low environmental awareness and patterns of unsustainable energy consumption. Vehicle ownership is often associated with mobility, independence and social stability rather than its ecological consequences, indicating a gap between awareness of clean air issues and concrete action. This trend directly increases emissions of CO, NO2 and PM2.5, worsening urban air quality and raising the risk of respiratory diseases. However, the transportation sector remains excluded from carbon tax schemes, making current fiscal policies partial and less effective in addressing one of the most immediate sources of urban pollution.

Conversely, the implementation of carbon taxes in the industrial sector has successfully encouraged energy efficiency and clean technology innovation, but its impact on public awareness remains limited. Under this scheme, environmental responsibility is largely institutional, involving only industrial actors subject to

fiscal obligations. As a result, awareness of responsibility for emissions is confined to corporate settings, while the public, as daily producers of emissions, remains unaffected. Consequently, ecological awareness has not developed into a broad social value but remains fragmented at technocratic and administrative levels.

This highlights that the success of policies for transitioning to a green economy is determined not only by macro-level regulations but also by public participation as co-producers in protecting the environment. Therefore, expanding policy coverage to the transportation sector is important not only to improve the effectiveness of emission reduction but also to encourage broader social awareness that clean air is the result of collective efforts, rather than only the responsibility of the state or large industries.

PRACTICAL IMPLICATION

From a practical policy perspective, the proposed framework highlights that the scope of sectoral coverage strongly influences the effectiveness of carbon taxes in achieving clean air. Under the current scheme, carbon taxes are mainly applied to large industrial sectors such as coal-fired power plants and manufacturing, where they have been effective in reducing carbon dioxide (CO2) emissions and promoting energy efficiency. However, their impact on urban air quality remains limited, as major pollutants such as fine particulate matter (PM2.5), carbon monoxide (CO) and nitrogen dioxide (NO2) largely originate from daily transportation activities. Consequently, the current carbon tax contributes more to climate change mitigation than to improving local air quality. This policy needs to be complemented by measures such as vehicle emission testing, improved access to public transportation and environmental education to enhance public health outcomes.

Conversely, the environmental and social impacts become more pronounced when carbon taxes are extended to cover the transportation sector. Taxing fossil fuels sends an economic signal that encourages shifts towards public transportation or electric vehicles while curbing the growth of conventional fuel-powered private vehicles. This approach not only reduces CO2 emissions but also lowers the levels of air pollutants that directly affect respiratory health. In the long term, this mechanism can steer the automotive industry towards low-emission innovation while also increasing individual ecological awareness. Therefore, integrating the transportation sector into the carbon tax scheme represents a strategic step to broaden public participation, strengthen emission control mechanisms and encourage behavioural change in energy consumption. With wider fiscal engagement and higher ecological awareness, carbon taxes can function not only as an economic instrument but also as a catalyst for shaping social values around the importance of maintaining clean air.

CONCLUSIONS

This study confirms that achieving better air quality and public health cannot rely solely on top-down fiscal policies but requires synergy between government strategies and active community participation. Clean air is positioned as the result of collective investment through the social investment framework, where the government provides policy direction and fiscal instruments, while the community acts as social investors who cultivate ecological awareness and responsibility in everyday life. The implementation of carbon taxes in the industrial sector marks an important step towards a low-carbon economy, yielding benefits in energy efficiency and institutional emission reduction. However, its narrow scope limits its impact on local air quality and public awareness, as transportation activities cause much of urban pollution. This gap between fiscal policy and the social reality of urban life highlights the importance of extending carbon taxation to the transportation sector as part of a more inclusive approach to emissions control. Ultimately, the success of environmental policy lies not only in reducing emissions but also in fostering a collective sense of ownership over urban sustainability. When designed as part of a shared social investment, carbon tax can serve as the foundation for a more environmentally conscious, responsible and empowered society in protecting the ecosystems in which they live.

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