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Carbon Taxation and Global Green Transition: A Bibliometric Analysis and Policy Framework for Vietnam

Nguyen Dang Khoa* and Le Tuan Manh
University of Economics Ho Chi Minh City, UEH Mekong, Vietnam
Corresponding author, E-mail: khoand@ueh.edu.vn

Abstract

This study presents a quantitative bibliometric analysis of 1,129 peer-reviewed articles on carbon taxation indexed in Scopus from 2020 through 2025. Utilizing VOSviewer keyword co-occurrence analysis with association strength normalization and Louvain modularity clustering (Q = 0.428), the literature is structured into five thematic clusters: policy design and labeling, emissions mitigation performance, economic distribution and double dividend dynamics, green technological innovation, and implementation feasibility in developing countries. Temporal overlay mapping and compound annual growth rate (CAGR) calculations reveal accelerating scholarly attention toward policy labeling (+44.8%) and developing economies (+42.3%). However, a substantial geographic concentration persists: OECD economies author over 63% of the corpus, whereas Southeast Asian (ASEAN) nations contribute only 3.19% (36 publications), within which merely 20 studies conduct country-level empirical or econometric evaluations. Utilizing a two-stage qualitative synthesis following the SPAR-4-SLR protocol, we identify ten critical research gaps. Grounded in these global findings, the study formulates an evidence-informed conceptual policy framework for Vietnam, featuring an empirically benchmarked three-phase roadmap (2025–2035) with initial rates of USD 5–10 per tCO2e scaling to USD 25–40 per tCO2e, an equity-focused revenue recycling mechanism (60% low-income household support, 40% green transition fund), macro-prudential green credit directives for the State Bank of Vietnam, and corporate adaptation strategies for the EU Carbon Border Adjustment Mechanism (CBAM).

Keywords: *carbon tax, bibliometric analysis, green transition, sustainable development, policy mix, Vietnam*

1. Introduction

Limiting global warming to 1.5°C above pre-industrial levels requires reducing net anthropogenic greenhouse gas (GHG) emissions by approximately 45% below 2010 levels by 2030 and reaching carbon neutrality around mid-century (Solecki et al., 2024). Achieving this objective entails massive reallocations of investment capital toward renewable energy and energy-efficient manufacturing. Among market-based policy instruments, carbon taxation is an established fiscal mechanism for pricing environmental externalities and accelerating industrial decarbonization. The economic rationale for carbon taxation rests on Arthur Pigou's welfare framework (Barnett, 1980; Pigou, 1920). Greenhouse gas emissions generate a global negative externality: industrial emitters release carbon dioxide without bearing the resulting economic and ecological damages. An explicit carbon tax internalizes these external costs, establishing an economy-wide price signal that guides private production and consumption choices toward least-cost abatement alternatives (Metcalf, 2021). In addition, carbon tax revenues can be recycled to reduce distortionary labor and capital taxes or fund low-carbon public infrastructure, consistent with the double dividend hypothesis (Metcalf & Weisbach, 2013).

Despite clear theoretical advantages, practical adoption varies widely across regions. While high-income European economies such as Sweden, Finland, and Norway have maintained carbon taxes for three decades, developing and emerging markets face distinct macroeconomic constraints (Köppl & Schratzenstaller, 2023). Scholarly research exhibits an empirical imbalance: while numerous studies examine carbon pricing in OECD jurisdictions, rigorous evaluations in developing nations remain scarce. Emerging economies operate under informal economic structures, administrative capacity limitations, and high dependence on fossil fuels. Direct transposition of Western policy blueprints without local calibration therefore poses substantial operational risks (Pila, 2024). Establishing precise boundaries between carbon taxation and adjacent policy mechanisms is essential for analytical rigor. A carbon tax is a price-based instrument that fixes the marginal cost of emissions while leaving aggregate mitigation volumes to decentralized market adjustment. Conversely, Emissions Trading Schemes (ETS) set quantitative caps and permit carbon prices to clear dynamically in secondary markets. Border carbon adjustments, notably the European Union's Carbon Border Adjustment Mechanism (CBAM), operate as border tariffs on imported carbon-intensive goods rather than domestic excise levies. Domestic environmental protection

taxes, exemplified by Vietnam's Law No. 57/2010/QH12, function primarily as physical excise taxes on fuels without calibrating to exact GHG emission factors. Finally, green finance frameworks govern credit allocations and risk weighting through central bank supervision rather than direct fiscal collection. Delineating these distinctions prevents conceptual conflation across instruments.

Vietnam exemplifies the challenge of balancing rapid industrial expansion with sustainability commitments. As a manufacturing hub in Southeast Asia, Vietnam has achieved sustained GDP growth, accompanied by rising GHG emissions and vulnerability to coastal flooding and typhoons. At COP26, the Government pledged to achieve net-zero emissions by 2050, followed by the enactment of the Revised Law on Environmental Protection (Law No. 61/2020/QH14). This statute provides legal authority to establish a domestic carbon market and explore environmental fiscal instruments. Nevertheless, Vietnam currently lacks an explicit carbon tax. Existing fuel taxes function as fiscal revenue sources rather than targeted carbon-pricing signals, leaving policy-makers without empirical guidance on how to sequence carbon taxation alongside an emerging emissions trading scheme. The operational imperative for domestic carbon pricing is reinforced by evolving international trade standards. The European Union's CBAM entered its transitional reporting phase in late 2023, with financial surrender obligations scheduled for 2026. Vietnamese exporters of steel, aluminum, cement, and fertilizer will face financial penalties unless an equivalent carbon price is paid domestically. Implementing a domestic carbon tax allows Vietnam to retain fiscal revenues within national borders while preserving the competitiveness of export-oriented manufacturing. Paralleling trade developments, financial supervisory frameworks in developing Asia increasingly integrate climate-related risks. The State Bank of Vietnam (SBV) and regional central banks recognize that carbon pricing alters the risk profile of high-carbon commercial assets. Synchronizing fiscal carbon price signals with green credit guidelines, taxonomy definitions, and prudential stress-testing directs private lending toward renewable generation and industrial energy efficiency.

Prior literature surveys on carbon taxation concentrate primarily on mature OECD experiences or provide narrative reviews of pre-2021 literature (Dias & Rocha, 2023; Köppl & Schratzenstaller, 2023; O'Mahony, 2020; Timilsina, 2022). For example, Timilsina (2022) surveyed global carbon tax experiences before the post-COP26 wave of net-zero legislation and border carbon adjustments. Similarly, Dias and Rocha (2023) mapped green taxation up to 2022 without addressing specific developing country institutional frictions. The present study advances beyond these reviews by evaluating 1,129 post-2020 Scopus-indexed publications, explicitly investigating the intellectual void concerning emerging Southeast Asian economies.

To address these questions, this study conducts a bibliometric synthesis of global carbon tax research published between 2020 and 2025. The inquiry pursues three specific objectives: first, mapping the global intellectual structure and thematic clusters using VOSviewer co-occurrence algorithms; second, identifying systematic research gaps, particularly regarding ASEAN economies; and third, translating these findings into an evidence-informed conceptual policy framework for Vietnam. This study makes three contributions. Methodologically, it establishes a reproducible bibliometric baseline of 1,129 post-2020 peer-reviewed articles, tracking keyword growth rates and cluster evolution in the net-zero era. Regionally, it documents the under-representation of Southeast Asia, where ASEAN member states account for 3.19% of global publications and only 20 empirical studies. Practically, it synthesizes global bibliometric findings and peer emerging-economy benchmarks into an integrated, evidence-informed policy framework for Vietnam, delineating phased price trajectories, an equity-focused revenue recycling mechanism, central bank green credit directives, and corporate trade adaptation strategies.

The remainder of this manuscript is organized as follows: Section 2 reviews theoretical principles and comparative mechanics. Section 3 outlines the data retrieval protocol, bibliometric algorithms, and two-stage gap identification methodology. Section 4 reports empirical network findings, cluster topologies, and identified research voids. Section 5 formulates the evidence-informed strategic policy framework and synthesis matrix for Vietnam. Section 6 concludes with research limitations and future academic directions.

2. Literature review and theoretical framework

2.1 Theoretical foundations of Pigouvian carbon taxation and dynamic incentives

Arthur Pigou established that competitive market prices fail to achieve social efficiency when economic activities generate unpriced external costs (Pigou, 1920). Greenhouse gas emissions represent a global negative externality because industrial facilities and energy consumers emit carbon dioxide without paying for resulting climate damages. A Pigouvian carbon tax remedies this market failure by imposing a fee per unit of emissions equal to the Social Cost of Carbon (SCC), defined as the net present value of climate damages caused by an additional ton of CO2 (Metcalf & Weisbach, 2013). Internalizing this cost aligns private production choices with social welfare, inducing polluters to reduce emissions where abatement is cheaper than paying the tax (Barnett, 1980).

Beyond static efficiency, environmental economics highlights the dynamic abatement incentives created by price-based instruments. Command-and-control standards provide no economic incentive for firms to reduce emissions below statutory limits. Under a carbon tax, however, each abated ton directly lowers tax liabilities, providing continuous incentives for process optimization and clean technology development (Metcalf, 2021). This ongoing incentive is crucial for deep decarbonization in capital-intensive sectors such as steel, cement, power generation, and petrochemicals.

Pigouvian taxation requires careful calibration in markets with imperfect competition. Barnett (1980) demonstrated that under monopoly or concentrated oligopoly, setting a carbon tax equal to marginal environmental damage can cause firms to contract output excessively, creating welfare losses from monopolistic underproduction. In developing economies where energy utilities and heavy industries are often state-owned enterprises (SOEs) operating under regulated pricing, cost pass-through behaves differently than in competitive markets. Carbon tax design in emerging economies must therefore account for industrial market concentration and administrative price regulations.

2.2 Comparative mechanics and architectural design: Carbon taxes versus quantity-based ETS

Market-based carbon pricing operates primarily through two instruments: carbon taxes (price-based) and Emissions Trading Schemes (ETS, quantity-based cap-and-trade). Martin Weitzman's (1974) price-versus-quantity framework indicates that when marginal abatement costs are steep and marginal environmental damages are flat, price instruments provide superior expected welfare by preventing price spikes. A carbon tax provides long-term price certainty, which reduces investment risks for capital-intensive clean technologies (Weitzman, 1974). In contrast, an ETS guarantees an aggregate emissions cap, leaving allowance prices to fluctuate with economic cycles and fuel markets.

The coverage and administrative cost of carbon pricing depend on the designated point of regulation. Metcalf (2021) identifies three administrative tiers: upstream, midstream, and downstream. An upstream tax applies where fossil fuels are extracted or imported, such as coal mine mouths, refineries, and fuel import terminals. Upstream systems offer near-total economy-wide coverage with low administrative overhead, requiring compliance from fewer than one hundred fuel suppliers who pass the tax downstream through energy prices. A midstream tax targets major industrial facilities, including thermal power plants, cement kilns, and steel mills, requiring facility-level emissions registries and verified reporting. A downstream tax applies at retail points of sale, providing direct price visibility to households but requiring extensive administrative infrastructure (Metcalf, 2021). Within this architectural spectrum, Marginal Abatement Cost (MAC) curves illustrate that uniform pricing across all sectors minimizes overall abatement costs by exhausting lowest-cost mitigation options first.

Empirical evidence across jurisdictions reflects diverse implementation pathways. High-income European countries, including Sweden, Finland, and Switzerland, instituted carbon taxes during the 1990s at rates now exceeding USD 100 per tCO2e, driving significant structural shifts toward biomass, district heating, and renewable electricity (Köppl & Schratzenstaller, 2023; World Bank, 2024). In contrast, emerging economies in Latin America and Asia have adopted lower initial rates to build administrative capacity. Chile (Law 20.780) and Colombia (Law 1819) introduced carbon taxes at approximately USD 5 per tCO2e, successfully establishing national MRV systems without impairing industrial growth (Mardones & Cabello, 2019; World Bank, 2023). In Southeast Asia, Singapore introduced its Carbon Pricing Act in 2019 at S$5 (~USD 3.75) per tCO2e, legislating

progressive increases to S$25 (~USD 19) in 2024–2025, S$45 (~USD 34) by 2026–2027, and S$50–80 by 2030 (NEA Singapore, 2024; World Bank, 2024). Indonesia enacted Law No. 7/2021 establishing a coal-fired power carbon tax at IDR 30,000 (~USD 2.00) per tCO2e, demonstrating the regional pattern of gradual rate phase-in (Putri et al., 2024).

A critical fiscal interaction concerns pre-existing fossil fuel subsidies. In many emerging economies, petroleum products and electricity receive indirect public subsidies to support living standards. Imposing a carbon tax while maintaining fossil fuel subsidies creates conflicting price signals, diluting environmental incentives and generating fiscal waste. Empirical evaluations show that phasing out inefficient fuel subsidies alongside progressive carbon taxation restores market price integrity, increases emission reductions, and frees fiscal resources for public investment (Coady et al., 2019; Parry et al., 2021). To address carbon market volatility, hybrid architectures increasingly combine emissions trading with statutory carbon tax price floors, ensuring predictable minimum price incentives for clean technology investors (Baranzini & Carattini, 2014).

2.3 Fiscal revenue recycling and the double dividend hypothesis

A distinguishing attribute of carbon taxation is the generation of substantial public revenues. The double dividend hypothesis posits that environmental taxes can generate both environmental gains through lower emissions and economic efficiency gains through revenue recycling (Goulder, 1995; Metcalf, 2021). The weak double dividend hypothesis states that using carbon revenues to reduce pre-existing distortionary taxes on labor or capital yields higher welfare than lump-sum rebates. The strong double dividend hypothesis suggests that this tax swap can produce a net gain in overall economic efficiency by reducing the excess burden of the pre-existing tax system (Goulder, 1995).

In emerging economies, the revenue recycling debate centers on distributional equity. Lower-income households spend a larger share of their income on cooking fuel, electricity, and basic transport than wealthier households. Consequently, an uncompensated carbon tax can be regressive, disproportionately affecting vulnerable families. Public finance literature demonstrates that directing a substantial portion of carbon revenues toward progressive cash transfers or energy assistance can fully neutralize regressive impacts, making the net fiscal reform progressive (Köppl & Schratzenstaller, 2023; Parry et al., 2021). Allocating the remaining revenues to a dedicated green fund provides co-financing for industrial energy efficiency and clean technology adoption.

2.4 Political economy, behavioral public economics, and policy labeling

Standard economic models assume economic agents respond purely to relative price changes. Behavioral public economics demonstrates, however, that political feasibility depends heavily on framing, perceived fairness, and institutional trust. Rabe and Borick (2012) showed that public support declines sharply when an environmental charge is labeled as a 'carbon tax' due to general tax aversion and skepticism regarding fiscal management. Support increases substantially when the identical measure is described as a 'climate dividend,' 'clean energy fee,' or 'transition levy,' especially when paired with transparent revenue earmarking (Rabe & Borick, 2012).

In developing countries, public confidence in fiscal institutions is a primary determinant of reform feasibility. If citizens suspect that carbon revenues will be absorbed into general government expenditures without discernible benefits, public opposition can stall implementation. Sustainable policy design requires transparent communication, clear earmarking for community welfare and renewable energy, and periodic public reporting on revenue utilization.

2.5 Developing economy realities, institutional constraints, and multi-policy synergy

Implementing carbon pricing in developing countries involves structural factors distinct from high-income OECD economies. Emerging markets typically have large informal sectors, constrained tax collection infrastructure, reliance on subsidized fossil fuels, and limited household financial reserves (Pila, 2024; Putri et al., 2024). Regulating small enterprises and agricultural producers downstream is administratively impractical and risks widespread evasion. Administrative feasibility therefore requires placing the tax upstream on commercial fuel extraction and imports, where monitoring is centralized.

Recent literature examines the operational utility of digital monitoring systems. Technologies such as IoT metering, satellite observation, and distributed ledgers reduce compliance costs and improve MRV accuracy

for resource-constrained administrations (Al Banjari & Rahman, 2025). Equally important, environmental fiscal instruments cannot function effectively in institutional isolation. Carbon pricing must operate alongside complementary measures, including renewable feed-in tariffs, industrial efficiency mandates, building codes, and central bank green lending directives (Talwar et al., 2023).

2.6 Prior bibliometric inquiries and research positioning

A critical examination of previous bibliometric reviews on carbon pricing reveals three distinct limitations. Earlier reviews (O'Mahony, 2020; Timilsina, 2022) surveyed literature published prior to 2021, missing the recent surge in scholarship prompted by national net-zero declarations and cross-border trade mechanisms. Second, general environmental taxation reviews (Dias & Rocha, 2023) aggregated disparate green levies without isolating carbon-specific instruments or addressing developing country institutional frictions. Third, recent systematic reviews in developing regions (Al Banjari & Rahman, 2025; Putri et al., 2024) relied on qualitative comparisons across small samples, lacking quantitative co-occurrence network mapping, modularity cluster detection, and longitudinal growth rate calculations. This paper fills these voids by analyzing 1,129 post-2020 Scopus-indexed articles, combining VOSviewer network algorithms with a two-stage qualitative gap identification protocol to build an actionable policy roadmap for Vietnam.

3. Research methodology

3.1 Data retrieval protocol and search matrix

To build a reproducible bibliometric dataset, this study extracted bibliographic records from the Scopus database (Elsevier), which offers comprehensive indexed coverage across environmental science, economics, energy technology, and policy analysis. Data retrieval was conducted on January 15, 2026, covering publications from 2020 through 2025 to capture scholarship produced following the Paris Agreement implementation framework and national net-zero declarations.

The Scopus search syntax was defined as: TITLE-ABS-KEY("carbon tax" OR "carbon taxation") AND PUBYEAR > 2019 AND PUBYEAR < 2026. To guarantee scientific quality, the retrieval was restricted to peer-reviewed Journal Articles (DOCTYPE, "ar"), explicitly excluding conference proceedings, book chapters, editorials, errata, and commercial trade notes. Subject areas were filtered to include Environmental Science; Economics, Econometrics and Finance; Energy; and Social Sciences. Language was restricted to English. Full bibliographic records (including author names, institutional affiliations, titles, years, journal names, abstracts, author keywords, index keywords, and citation counts) were exported in CSV and RIS formats. An automated deduplication check using Digital Object Identifiers (DOIs) and normalized titles verified zero duplicate entries, producing a clean sample of N = 1,129 peer-reviewed articles.

Prior to network analysis, thesaurus cleaning was conducted to normalize morphological and semantic variations. Singular and plural forms were unified (e.g., 'carbon taxes' to 'carbon tax'; 'greenhouse gases' to 'greenhouse gas'), regional spelling variations were standardized (e.g., 'behaviour' to 'behavior'), and synonymous expressions were consolidated (e.g., 'co2 emission' and 'greenhouse gas emissions' to 'carbon emissions'). This standardization prevented artificial network fragmentation while preserving distinct conceptual categories.

3.2 Bibliometric network algorithms, VOSviewer parameters, and temporal metrics

Bibliometric mapping was conducted using VOSviewer (version 1.6.20) (van Eck & Waltman, 2010, 2020). The Full Counting method was employed, assigning equal weight to each co-occurrence event. To isolate core intellectual relationships while removing idiosyncratic author terms, a minimum occurrence threshold was set at T >= 10 occurrences. Exactly 247 standardized keywords met this threshold out of 4,812 total extracted terms, interconnected by 15,847 co-occurrence linkages.

To normalize co-occurrence frequencies and account for node size differences, VOSviewer computes the association strength s_ij between keyword i and keyword j, defined in Equation (1):

$$s_{ij} = \frac{c_{ij}}{w_i \cdot w_j}$$

In Equation (1), c_ij denotes the co-occurrence count of keyword i and keyword j across the document corpus, while w_i and w_j represent the total link strengths of keywords i and j. This normalization prevents high-frequency generic terms from distorting cluster geometry.

VOSviewer applies modularity optimization using the Louvain algorithm to partition the network into distinct thematic clusters. The objective function maximizes network modularity Q, defined in Equation (2):

$$Q = \frac{1}{2m}\sum_{i,j}\left[A_{ij} - \frac{k_i k_j}{2m}\right]\delta(c_i, c_j)$$

In Equation (2), A_ij denotes the edge weight between nodes i and j, k_i and k_j represent the total link weights connected to nodes i and j, m is total network edge weight, and delta(c_i, c_j) is an indicator function yielding 1 if nodes i and j belong to the same cluster and 0 otherwise. Modularity optimization was parameterized with a resolution of 1.00, a minimum cluster size of 20 keywords, small cluster merging enabled, attraction set to 2, and repulsion set to -1. The algorithm converged to a stable five-cluster partition with an overall network modularity of Q = 0.428, indicating dense intra-cluster linkages and clear thematic separation.

To evaluate temporal keyword growth across the 2020–2025 window, we compute the 5-Year Compound Annual Growth Rate (CAGR), defined in Equation (3):

$$\mathbf{CAGR}_{(2020-2025)} = \left(\mathbf{N}_{2025} / \mathbf{N}_{2020}\right)^{1/5} - \mathbf{1}$$

In Equation (3), N_2020 and N_2025 represent annual keyword frequencies in 2020 and 2025, respectively. For emerging terms with zero baseline occurrences in 2020, a standard Laplace continuity adjustment (N_2020 + 1) was applied to prevent division by zero.

3.3 Two-stage systematic gap identification protocol

Methodological rigor requires separating quantitative network topology from qualitative gap synthesis. Bibliometric algorithms identify structural properties, including degree centrality, link density, and peripheral subgraphs, but cannot validate substantive research gaps without structured content analysis. This study applies a two-stage hybrid protocol based on SPAR-4-SLR and PRISMA 2020 guidelines:

Stage 1 (Quantitative Network Topology Screening): The 247-node co-occurrence network was screened to locate structural anomalies: (a) subgraphs with high centrality but low geographic representation; (b) peripheral keyword nodes with low density; and (c) isolated thematic dyads indicating disconnected research sub-fields.

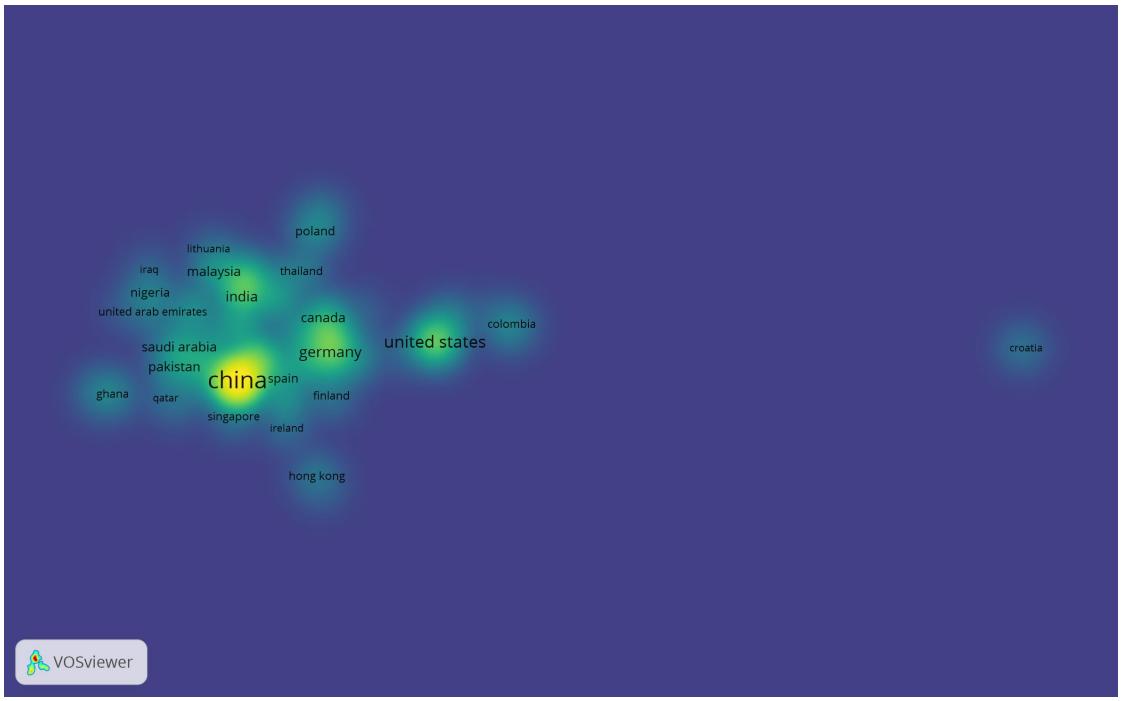
Stage 2 (Structured Qualitative Content Coding): For each identified topological anomaly, two independent researchers conducted full-text content coding on relevant article sub-samples. Documents were coded by geographic focus, empirical methodology (econometric, CGE, microsimulation, or conceptual), regulatory scope, and explicit author recommendations. The convergence of quantitative scarcity and qualitative coding consensus validated the ten research gaps.

4. Empirical results and bibliometric synthesis

4.1 Overview of data and global geographical distribution

The dataset contains 1,129 peer-reviewed journal articles published between 2020 and 2025. Publication output grew steadily across the observation period, reflecting expanding academic engagement following net-zero announcements and cross-border carbon border discussions. The network comprises 247 standardized keywords meeting the threshold of T >= 10, connected by 15,847 co-occurrence links.

Geographical analysis based on institutional author affiliations indicates substantial geographic concentration. European institutions author 35.2% of analyzed publications, followed by North America (28.7%) and Asia (24.1%). High-income OECD economies in Europe and North America collectively account for over 63% of the literature, reflecting long-established research programs, empirical data availability, and decades of operational carbon tax experience.



Source: Compiled by authors from Scopus dataset (2020–2025)

Figure 1 Global geographical distribution of carbon tax literature (2020–2025)

Developing regions contribute smaller shares of the literature. African institutions represent 6.8% of publications, Oceania contributes 3.1%, and Latin America accounts for 2.1%. Within Southeast Asia, ASEAN member states collectively represent exactly 3.19% of global publications (36 articles out of 1,129). Qualitative content screening reveals that only 20 of these 36 studies conduct country-level empirical modeling, econometric estimation, or computable general equilibrium (CGE) evaluations of carbon pricing policies. These 20 empirical studies represent 1.77% (~1.8%) of the global corpus, while accounting for 55.6% (20/36) of all ASEAN carbon tax research. The remaining 16 ASEAN publications represent conceptual overviews, legal commentaries, or general environmental policy reviews. This scarcity of empirical studies underscores a critical research void regarding carbon pricing feasibility in Southeast Asian industrializing economies.

4.2 High-frequency keyword analysis and growth dynamics

Keyword frequency analysis identifies core thematic anchors and expanding research frontiers. Table 1 lists the top 20 high-frequency keywords ranked by total occurrence frequency, along with percentage document representation, cluster assignment, and 5-Year Compound Annual Growth Rates (CAGR) computed using Equation (3).

Table 1 Top 20 high-frequency keywords in carbon tax literature (2020–2025)

Rank	Keyword	Occurrences	Share (%)	Cluster	5-Year CAGR (2020–2025)
1	carbon tax	634	56.2%	1	+12.3%
2	carbon emissions	512	45.3%	2	+18.7%
3	greenhouse gas	401	35.5%	2	+15.2%
4	policy making	387	34.3%	1	+22.1%
5	green technology	356	31.5%	4	+31.4%
6	developing countries	298	26.4%	5	+42.3%

Rank	Keyword	Occurrences	Share (%)	Cluster	5-Year CAGR (2020–2025)
7	energy transition	287	25.4%	4	+41.2%
8	environmental impact	276	24.4%	2	+14.6%
9	climate change	265	23.5%	2	+16.8%
10	innovation	243	21.5%	4	+35.8%
11	income	232	20.5%	3	+19.4%
12	taxes	221	19.6%	3	+13.5%
13	double dividend	198	17.5%	3	+24.6%
14	cost-benefit analysis	187	16.6%	3	+17.2%
15	implementation	176	15.6%	5	+38.9%
16	feasibility	165	14.6%	5	+29.7%
17	government policy	154	13.6%	1	+20.5%
18	renewable energy	143	12.7%	4	+28.3%
19	africa	132	11.7%	5	+27.1%
20	policy labeling	124	11.0%	1	+44.8%

Source: Compiled by authors from Scopus database (2020–2025)

Foundational search terms such as 'carbon tax' (634 occurrences, 56.2%), 'carbon emissions' (512 occurrences, 45.3%), and 'greenhouse gas' (401 occurrences, 35.5%) dominate frequency totals. However, growth rate metrics show that the most rapidly expanding topics concern implementation realities and communication dynamics. The highest 5-Year CAGRs are observed for 'policy labeling' (+44.8%), 'developing countries' (+42.3%), 'energy transition' (+41.2%), 'implementation' (+38.9%), and 'innovation' (+35.8%). This structural shift reflects an evolving academic consensus that key decarbonization hurdles now reside in practical execution, public acceptance, and clean technology adoption in emerging economies.

4.3 Co-occurrence cluster analysis

Modularity optimization partitioned the 247 keywords into five thematic clusters. Figure 2 displays the keyword co-occurrence map, where node size corresponds to keyword occurrence frequency, line thickness indicates association strength, and colors denote cluster assignments.

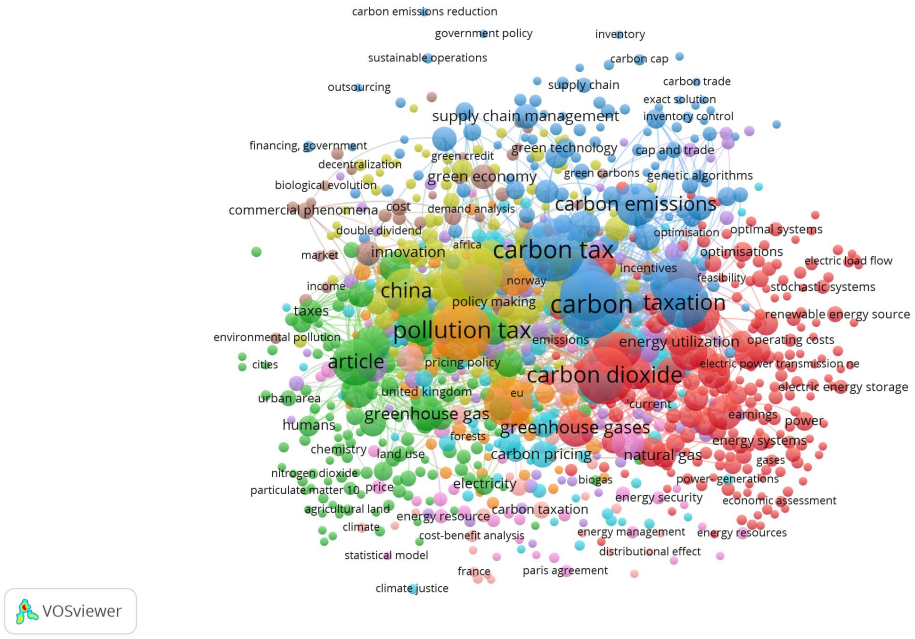


Figure 2 Keyword co-occurrence network map generated via VOSviewer

Source: Generated by authors using VOSviewer (v1.6.20)

Table 2 presents the quantitative and qualitative characteristics of each cluster, reporting the number of keywords (n), keyword weight (the percentage share out of 247 standardized keywords, nk/247 x 100%), Total Link Strength (TLS), average citations per keyword, average publication year, and primary analytical scope.

Table 2 Quantitative and qualitative breakdown of research clusters

Cluster	Theme Name	Keywords (n)	Weight (%)	TLS	Avg. Citations	Avg. Pub Year	Analytical Focus & Scope
1 (Green)	Policy Making & Labeling	52	21.1%	4,821	24.6	2022.8	Carbon tax architecture, legal design, behavioral framing, political feasibility.
2 (Blue)	Emissions Reduction & Mitigation	48	19.4%	4,512	31.2	2021.9	Econometric mitigation tracking, abatement efficacy, sectoral GHG monitoring.
3 (Yellow)	Economic & Distributional Effects	46	18.6%	3,984	28.5	2022.3	CGE modeling, revenue recycling, double dividend, progressivity vs. regressivity.
4 (Red)	Green Technology & Innovation	51	20.6%	4,320	22.1	2023.2	Induced innovation, clean R&D capital, renewable energy integration, smart tech.
5 (Purple)	Implementation in Developing Contexts	50	20.3%	3,892	18.4	2023.6	Institutional capacity, administrative frictions, informal sector, emerging markets.

Source: Compiled by authors from VOSviewer clustering results

Substantive examination of the clusters indicates five distinct domains:

Cluster 1 (Policy Making & Labeling, Green, 52 keywords, 21.1% weight, TLS = 4,821): Forms the governance foundation of the network. Articles evaluate fiscal legislation, statutory design, and communication framing. Findings show that public opposition often reflects loss aversion and tax skepticism, demonstrating that policy labeling, such as framing charges as clean energy transition contributions, improves public acceptability (Rabe & Borick, 2012).

Cluster 2 (Emissions Reduction & Mitigation, Blue, 48 keywords, 19.4% weight, TLS = 4,512): Represents empirical evaluations of mitigation effectiveness. Econometric studies evaluate whether implemented carbon taxes deliver measurable reductions in emissions. Findings confirm that tax signals reduce emissions intensity, though long-term efficacy depends on fuel substitution options and cross-border leakage controls (Baranzini & Carattini, 2014).

Cluster 3 (Economic & Distributional Effects, Yellow, 46 keywords, 18.6% weight, TLS = 3,984): Examines general equilibrium modeling and welfare incidence. Studies evaluate the double dividend hypothesis, showing that uncompensated carbon pricing acts regressively in lower-income settings unless balanced by targeted revenue recycling, such as progressive transfers to energy-poor households (Goulder, 1995; Metcalf, 2021).

Cluster 4 (Green Technology & Innovation, Red, 51 keywords, 20.6% weight, TLS = 4,320): Grounded in induced innovation theory, this cluster analyzes how carbon price signals stimulate private R&D in renewable power, battery storage, and grid modernization. Publications also investigate digital systems, including IoT sensors, to streamline carbon accounting (Talwar et al., 2023).

Cluster 5 (Implementation in Developing Contexts, Purple, 50 keywords, 20.3% weight, TLS = 3,892): Analyzes administrative and institutional frictions in non-OECD jurisdictions. Studies address weak MRV capacity, informal sector leakage, and household energy access constraints (Pila, 2024; Putri et al., 2024). This cluster exhibits the most recent average publication year (2023.6), representing the current global research frontier.

4.4 Evolutionary trajectory (2020–2025)

Temporal overlay mapping indicates three sequential phases in carbon tax literature between 2020 and 2025:

Phase 1: Theoretical Modeling and Instrument Comparisons (2020–2021): Research concentrated on general equilibrium simulations, optimal Pigouvian tax calibrations, and theoretical debates comparing carbon taxes against cap-and-trade systems.

Phase 2: Ex-Post Econometric Evaluation and Behavioral Dynamics (2022–2023): Focus shifted to empirical evaluations of operational European and North American carbon tax systems, examining emissions outcomes, economic impacts, and public perception framing.

Phase 3: Digital MRV Integration and Developing Economy Realities (2024–2025): Inquiries expanded into implementation challenges in emerging markets, cross-border carbon border adjustments (CBAM), and digital technology applications for automated emissions verification.

4.5 Systematic research gap identification

Applying the two-stage gap identification protocol across network topological anomalies and qualitative content coding identified ten critical research gaps. Table 3 presents these gaps, detailing descriptions, quantitative bibliometric evidence, priority levels, and prospective research avenues.

Table 3 Systematic identification of research gaps in carbon tax literature

No.	Research Gap Domain	Detailed Description	Quantitative Evidence	Key Sources	Priority	Research Opportunities
1	Scarcity of ASEAN Empirical Studies	Severe under-representation of Southeast Asian nations; acute shortage of empirical and econometric evaluations in ASEAN.	20/1,129 studies (1.8% of global total; 20/36 ASEAN studies, 55.6%)	Putri et al. (2024)	High	Country-level econometric evaluations, CGE modeling for ASEAN economies.

No.	Research Gap Domain	Detailed Description	Quantitative Evidence	Key Sources	Priority	Research Opportunities
2	Distributional Equity in Developing Nations	Limited empirical micro-simulations evaluating carbon tax welfare incidence across household income deciles in emerging markets.	67/1,129 studies (5.9%)	Al Banjari & Rahman (2025); Pila (2024)	High	Household expenditure micro-simulations, progressive energy rebate design.
3	Policy Labeling in Asian Institutional Contexts	Policy framing studies focus almost exclusively on Western jurisdictions; evidence on Asian public perception is absent.	8/124 labeling studies (6.5%)	Rabe & Borick (2012)	Medium	Choice experiments, public willingness-to-pay surveys in Asian contexts.
4	Long-Term Longitudinal Impact Evaluations	Dominance of static or short-term econometric models; shortage of multi-year longitudinal impact assessments (>5 years).	34/1,129 studies (3.0%)	Köppl & Schratzenstaller (2023)	Medium	Longitudinal panel econometrics, dynamic investment response modeling.
5	Informal Economy and Tax Leakage Dynamics	Limited modeling of carbon tax pass-through, informal sector leakage, and evasion in economies with large informal workforces.	42/1,129 studies (3.7%)	Pila (2024)	High	Informal sector general equilibrium modeling, upstream administrative design.
6	Digital MRV Technology Integration	Scarcity of research examining IoT sensors, smart metering, and blockchain platforms for automated carbon tax administration.	29/1,129 studies (2.6%)	Talwar et al. (2023)	Medium	Digital tax compliance architectures, IoT-based verification pilot studies.
7	Empirical Testing of Induced Green Innovation	Theoretical claims of induced innovation often lack robust firm-level empirical validation in industrializing contexts.	88/1,129 studies (7.8%)	Metcalf (2021)	Medium	Firm-level patent filing analysis, green R&D expenditure econometric tracking.
8	Interactions within Complex Policy Mixes	Limited empirical investigation into coordinating carbon taxes with parallel ETS, subsidies, and energy feed-in tariffs.	51/1,129 studies (4.5%)	Baranzini & Carattini (2014)	High	Hybrid carbon tax-ETS modeling, multi-instrument policy optimization.

No.	Research Gap Domain	Detailed Description	Quantitative Evidence	Key Sources	Priority	Research Opportunities
9	Financial Sector and Green Credit Synergies	Few studies examine interactions between fiscal carbon pricing, banking supervision, and central bank green taxonomy frameworks.	38/1,129 studies (3.4%)	Talwar et al. (2023)	Medium	Banking climate stress-testing, central bank green credit transmission models.
10	Socio-Cultural Acceptance and Trust Dynamics	Limited integration of institutional trust, civic culture, and social capital variables into political feasibility analysis.	56/1,129 studies (5.0%)	O'Mahony (2020)	Medium	Sociological trust surveys, political economy feasibility analysis.

Source: Compiled by authors from bibliometric systematic gap analysis

5. Policy implications and strategic framework for Vietnam

This section translates the global bibliometric evidence and identified emerging-economy research gaps into an evidence-informed policy framework tailored to Vietnam's macroeconomic and institutional context. Table 4 delineates this cross-thematic synthesis, mapping each bibliometric cluster and gap to its underlying theoretical foundation and corresponding strategic action across three key institutional pillars: the Government of Vietnam, the State Bank of Vietnam (SBV), and domestic enterprises.

Table 4 Synthesis Matrix: Mapping Bibliometric Findings and Gaps to Strategic Policy Actions for Vietnam

Cluster & Gap	Bibliometric & Empirical Finding	Theoretical Rationale	Strategic Policy Action for Vietnam
Cluster 1 & Gap 3 (Policy Labeling)	High CAGR (+44.8%); severe lack of Asian perception studies (6.5%). Public tax aversion is severe.	Behavioral public economics; loss aversion and perceived fairness (Rabe & Borick, 2012).	Frame carbon levy as 'Clean Energy Transition Contribution'; earmark revenues visibly for public benefit.
Cluster 2 & Gap 8 (Policy Mix & ETS)	Carbon pricing requires synergy with parallel regulations; uncoordinated ETS creates double taxation.	Weitzman (1974) price-quantity interaction; hybrid price-floor theory (Baranzini & Carattini, 2014).	Synchronize upstream fuel carbon tax with Vietnam's pilot ETS (Law 61/2020/QH14); exempt covered point sources.
Cluster 3 & Gap 2 (Distributional Equity)	Uncompensated carbon taxes act regressively in developing countries (5.9% literature share).	Double dividend hypothesis; progressive revenue recycling equity (Metcalf, 2021; Parry et al., 2021).	Adopt 60/40 revenue recycling: 60% targeted transfers to poor households, 40% to Green Transition Fund.
Cluster 4 & Gap 7 & Gap 9 (Tech & Green Credit)	Carbon tax drives clean R&D (+35.8% CAGR), but capital market frictions impede industrial adoption.	Induced innovation hypothesis; financial transition risk theory (Talwar et al., 2023).	SBV issues green taxonomy, climate risk stress testing ($10/$30/$50), and preferential green refinancing.
Cluster 5 & Gap 1 & Gap 5 (Developing Contexts)	ASEAN literature represents only 3.2% (only 20 empirical studies); weak MRV and informal sector leakage.	Administrative feasibility under fiscal capacity constraints (Pila, 2024; Putri et al., 2024).	Implement 3-phase roadmap: USD 5–10 upstream rate (2025–2027) scaling to USD 25–40 (2031–2035); regional ASEAN MRV.

Source: Synthesized by authors from bibliometric clusters and policy literature

5.1 Strategic recommendations for the Government of Vietnam

1. Three-Phase Implementation Roadmap (2025–2035): To balance industrial expansion with decarbonization goals, policy-makers should sequence implementation through a calibrated, three-stage roadmap. The proposed tax rate benchmarks are derived from empirical experiences in peer emerging economies:

• Phase 1: Institutional Preparation and MRV Capacity Building (2025–2027): Focus on establishing baseline facility-level emissions inventories, issuing standardized Measurement, Reporting, and Verification (MRV) regulations under Law No. 61/2020/QH14, and instituting public communication campaigns. Consistent with early-stage experiences in Chile and Colombia (USD 5 per tCO2e; Mardones & Cabello, 2019) and Singapore (S$5 per tCO2e; NEA Singapore, 2024), an initial pilot carbon tax of USD 5–10 per tCO2e should be introduced on primary fossil fuel imports and coal-fired thermal power generation. This modest initial price establishes fiscal collection infrastructure, familiarizes domestic enterprises with carbon accounting, and builds administrative capacity without shocking manufacturing competitiveness.

• Phase 2: Pilot Domestic ETS Integration and Scope Expansion (2028–2030): Expand coverage to intermediate energy-intensive industrial sectors (steel, cement, aluminum, basic chemicals). Concurrently operationalize Vietnam's pilot Emissions Trading Scheme (ETS), establishing clear administrative boundaries to exempt installations covered under the ETS allowance cap from domestic carbon taxes on fuels, thereby eliminating double taxation and minimizing compliance friction (Baranzini & Carattini, 2014).

• Phase 3: Gradual Rate Escalation and International Convergence (2031–2035): Progressively escalate the statutory carbon tax rate to USD 25–40 per tCO2e by 2035, mirroring Singapore's legislated trajectory toward S$45–80 per tCO2e (NEA Singapore, 2024) and reflecting regional price convergence. This price escalation is crucial to narrow the price differential with the EU CBAM (where EU ETS allowance prices fluctuate between EUR 60–90 per tCO2e), ensuring that carbon revenues are retained in Vietnam's national treasury rather than surrendered to European customs authorities at importation.

2. Revenue Recycling and Equity Considerations: Grounded in double dividend principles and public finance empirical literature (Goulder, 1995; Metcalf, 2021; Parry et al., 2021), the framework proposes an illustrative 60/40 revenue allocation model. In Vietnam, low-income urban and rural households expend substantial portions of disposable income on energy, electricity, and transportation. Allocating 60% of total carbon tax revenues toward targeted cash transfers, lifeline electricity credits, and public transit subsidies neutralizes regressive price impacts and maintains social cohesion. The remaining 40% should be earmarked into a dedicated National Green Transition Fund to co-finance industrial energy efficiency, renewable mini-grid electrification, and clean technology deployment.

3. Policy Communication and Framing ('Policy Labeling'): Drawing directly from Cluster 1 insights and behavioral public economics (Rabe & Borick, 2012), authorities should avoid generic 'tax' terminology that triggers public tax aversion. Re-framing the policy as a 'Clean Energy Transition Contribution' or 'Green Development Fund Levy,' paired with transparent annual reporting on revenue disbursement to households and local schools and hospitals, is vital to securing durable civic acceptance.

4. Administrative Upstream Point of Regulation: In accordance with Cluster 5 findings on informal economy leakage and administrative capacity limits (Pila, 2024), Vietnam should establish its primary point of regulation upstream at petroleum refineries, coal import terminals, and natural gas processing hubs. Upstream administration captures over 85% of total fossil combustion emissions through fewer than 100 corporate collection entities, drastically reducing evasion opportunities compared to downstream retail collection.

5. Regional ASEAN Harmonization: Policy-makers should engage actively with ASEAN peers through the ASEAN Working Group on Climate Change (AWGCC) to harmonize MRV technical guidelines, exchange pilot carbon pricing experiences, and mitigate regional carbon leakage.

5.2 Recommendations for the State Bank of Vietnam (SBV / NHNN)

The justification for central bank involvement derives directly from Cluster 4 (Green Technology & Innovation) and Gap 9 (Financial Sector Synergies). Introducing carbon pricing alters the risk profile of industrial assets, making high-emission enterprises vulnerable to credit downgrades and stranding risks. The State Bank of Vietnam plays a crucial macro-prudential role in aligning the financial system with fiscal carbon policy:

1. Green Credit Taxonomy and Preferential Refinancing: The SBV should expedite the finalization of the National Green Taxonomy, establishing rigorous technical screening criteria for green lending. To amplify capital reallocation, the central bank can implement targeted refinancing facilities or risk-weighted capital adjustments for commercial banks that expand credit allocations to certified energy efficiency and clean energy projects.

2. Climate Risk Stress-Testing in Banking Supervision: The SBV should mandate climate transition risk stress-testing across commercial banking portfolios under hypothetical carbon price scenarios (e.g., USD 10 per tCO2e, USD 30 per tCO2e, USD 50 per tCO2e), evaluating bank capital adequacy against loan default risks in carbon-intensive sectors (coal power, cement, steel).

3. Corporate Green Bond Market Facilitation: In coordination with the Ministry of Finance, the SBV can streamline issuance frameworks and credit enhancement mechanisms for green bonds, mobilizing private capital to co-finance long-term clean infrastructure investments.

5.3 Strategic guidelines for domestic enterprises

1. Standardized GHG Accounting and MRV Systems: Domestic enterprises, particularly export-oriented manufacturers, must institutionalize Scope 1, Scope 2, and Scope 3 GHG inventory accounting aligned with international standards (e.g., GHG Protocol, ISO 14064).

2. Capital Investments in Clean Technology and Energy Efficiency: In line with Cluster 4 findings, firms should accelerate investments in waste heat recovery, rooftop solar generation, and high-efficiency electric motors, hedging against future domestic carbon taxes and volatile fossil fuel prices.

3. Proactive Trade Compliance for EU CBAM: Exporters in CBAM-covered sectors (steel, aluminum, cement, fertilizers) must establish auditable embedded emissions documentation to maintain European market access and avoid border tariff penalties.

5.4 Policy implementation synergies and cross-institutional governance

The proposed framework integrates fiscal pricing, monetary supervision, and enterprise adaptation into a synchronized transition architecture. While individual policy interventions, including upstream fuel levies and green credit directives, offer partial mitigation incentives, their macroeconomic efficacy depends on cross-institutional alignment. First, the price trajectory established by the Ministry of Finance provides the clear economic signal necessary for firms to internalize carbon costs, while the 60/40 revenue recycling mechanism safeguards low-income households against regressive energy price shocks and capitalizes clean infrastructure funds. Second, the State Bank of Vietnam's green credit taxonomy and climate stress-testing mitigate balance-sheet vulnerabilities in carbon-intensive lending, facilitating the reallocation of private capital toward energy-efficient manufacturing. Third, proactive enterprise adherence to international MRV protocols and clean technology adoption hedges domestic industry against impending international border adjustments such as the EU CBAM. By translating global bibliometric findings and peer emerging-economy benchmarks into actionable national guidelines, this multi-pillar framework establishes a structured strategic foundation to guide Vietnam's institutional roadmap toward its 2050 net-zero commitments.

6. Conclusion, limitations, and future research

This study conducted a comprehensive bibliometric synthesis of 1,129 peer-reviewed journal articles on carbon taxation indexed in the Scopus database from 2020 through 2025. Utilizing VOSviewer network algorithms with association strength normalization and Louvain modularity optimization ($Q = 0.428$), the literature was organized into five thematic clusters: policy design and labeling, emissions mitigation performance, economic distribution and double dividend dynamics, green technological innovation, and implementation feasibility in developing countries. Temporal trajectory analysis revealed that scholarly focus is shifting from theoretical general equilibrium modeling toward behavioral communication, digital MRV integration, and emerging market execution.

The quantitative analysis revealed a stark geographical asymmetry: high-income OECD economies account for over 63% of published research, whereas Southeast Asian (ASEAN) nations represent merely 3.19% (36 publications), within which only 20 studies conduct country-level empirical modeling. To bridge these global

insights with Vietnam's 2050 net-zero targets, the paper synthesized an evidence-informed policy framework featuring a phased implementation roadmap (2025–2035), an equity-focused 60/40 revenue recycling mechanism, central bank green credit directives, and corporate CBAM adaptation strategies.

Notwithstanding these contributions, several methodological limitations must be explicitly acknowledged to contextualize the findings:

1. Single-Database Coverage: The analysis relied exclusively on the Scopus database. While Scopus offers extensive curated peer-reviewed coverage, future research could integrate Web of Science, Dimensions, or Google Scholar to capture additional interdisciplinary journals.

2. Linguistic and Gray Literature Boundary: By restricting the retrieval to English-language peer-reviewed journal articles, this study excludes domestic Vietnamese-language publications, governmental white papers, and ministerial consultancy reports that contain valuable localized institutional insights.

3. Query Keyword Restrictions: The search syntax targeted 'carbon tax' and 'carbon taxation.' Consequently, publications focusing exclusively on 'cap-and-trade' or 'emissions trading systems' without co-indexing carbon tax keywords were outside the core analytical corpus.

4. Database Indexing Lags: Publications from late 2025 may experience citation indexation lags, temporarily moderating their measured citation impact relative to earlier articles.

5. Thesaurus Standardization Subjectivity: Although rigorous coding rules were followed, keyword thesaurus cleaning inherently involves researcher judgment in merging synonymous technical terms.

6. Non-Causal Nature of Network Mapping: Bibliometric co-occurrence networks identify statistical association strengths and intellectual community structures, but cannot independently demonstrate causal policy effectiveness or measure macroeconomic welfare outcomes.

Future empirical research should prioritize: (a) dynamic Computable General Equilibrium (CGE) modeling to simulate sectoral output, trade balance, and employment impacts of carbon taxation in Vietnam; (b) household survey micro-econometric simulations to assess decile-specific distributional welfare effects; and (c) empirical discrete choice experiments to evaluate public willingness to pay and policy labeling preferences within Southeast Asian civic environments.

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