Mapping the Nexus between Green Taxation and Technological Innovation in Enterprises: A Bibliometric Analysis

Zhang Zelin*, Mui Yee Cheok

Tun Razak Graduate School (TRGS), University Tun Abdul Razak (UNIRAZAK)

***Corresponding Author**

DOI: https://dx.doi.org/10.47772/IJRISS.2025.905000506

Received: 17 May 2025; Accepted: 21 May 2025; Published: 25 June 2025

ABSTRACT

Amid the global push toward green transformation, the nexus between green taxation and enterprise technological innovation has emerged as a critical policy and research domain. However, fragmented institutional contexts and methodological divergence hinder cross-national knowledge integration. This study conducts a comparative bibliometric analysis of Chinese and international literature (2000–2025) to map structural trends, thematic evolution, and conceptual pathways in this field. Using CiteSpace (version 6.4.R6), we analyze 335 core publications from Web of Science and CNKI, incorporating keyword co-occurrence, cluster analysis, author and institutional networks, and temporal bursts. Additionally, we integrate grey literature from government agencies and international organizations to enhance policy relevance and institutional grounding. Findings reveal a shared three-stage evolution—policy experimentation, mechanism construction, and performance optimization—but divergent focal points: international studies emphasize systemic policy synergy and macro-level modeling, while Chinese research focuses on micro-level firm behavior and institutional adaptation. A nested conceptual framework is proposed to illustrate cross-scale linkages among national policies, industrial structures, and enterprise innovation responses. This research contributes to theory by synthesizing multi-level incentive mechanisms and enriching bibliometric methodology through policy-embedded validation. It also informs future scholarship by identifying key research gaps and proposing five directions for cross-contextual integration and simulation modeling. The study offers a novel lens for understanding green tax innovation dynamics and serves as a foundation for future comparative and interdisciplinary inquiry.

Keywords: Green Taxation; Technological Innovation; Bibliometric Mapping; Cross-National Comparison

INTRODUCTION

The 21st century is widely regarded as a pivotal era for global green transformation (United Nations Environment Programme, 2021). In response to escalating climate risks and growing resource constraints, nations have increasingly adopted cleaner production systems and low-carbon technological innovation as strategic tools to enhance economic resilience and achieve sustainable development goals (Cai et al., 2024). Within this global shift, green taxation has emerged as a core policy instrument that blends regulatory intervention with market-based incentives (Bashir et al., 2024).

Since Sweden introduced the world's first carbon tax in 1990, over 40 countries and regions have implemented various forms of green taxation, often supplemented with fiscal incentives to promote eco-innovation (World

Bank, 2024). The European Union's 2001 Environmental Tax Reform Guidelines institutionalized the "polluter pays" principle and fostered technology-driven taxation (European Commission, 2021). The Carbon Border Adjustment Mechanism (CBAM), enacted in 2023, further elevated the strategic relevance of green taxation within international trade regimes (EU Regulation No. 2023/956). In the United States, the Inflation Reduction Act (2022) leverages tax credits to stimulate R&D in renewable energy, carbon capture, and sustainable materials while facilitating firm-level coordination through carbon market mechanisms (Congressional Research Service, 2022). In East Asia, countries such as Japan and South Korea have implemented integrated fiscal systems—including green consumption and resource recycling taxes—to support eco-innovation across product life cycles (OECD, 2024, 2025). Emerging economies, including India and South Africa, have phased out energy subsidies in favor of carbon and pollution taxes, redirecting revenues toward low-carbon industrial upgrading (IMF, 2023; World Bank, 2023).

Cumulatively, green taxation has evolved from a regulatory tool into a strategic lever for stimulating corporate green innovation and enhancing national sustainable competitiveness (Zhang et al., 2023; Yang et al., 2024). However, China's green tax regime remains in its nascent phase, anchored primarily by the 2018 Environmental Protection Tax Law and pilot reforms in ad valorem resource taxation. The current framework lacks comprehensive incentive structures, institutional coordination, and policy breadth (Xu, 2025). In alignment with the 14th Five-Year Plan and the national "dual-carbon" strategy, Chinese authorities have proposed accelerating the development of an integrated fiscal, tax, investment, and pricing system to support green development goals (The Central Committee of the Communist Party of China & The State Council, 2024).

Against this backdrop, the relationship between green taxation and enterprise-level technological innovation has garnered increasing academic attention. International literature explores the evolution of tax incentives, policy tool integration, firm-level heterogeneity, and the directionality of green innovation. A growing body of evidence shows that green taxes enhance green patent output and technological investment, especially in carbon-intensive sectors (Liu et al., 2023; Wang et al., 2024). Scholars have further examined policy synergies. Chorzewska et al. (2025) argue that a sequential policy strategy—"subsidies first, taxes later"—is more effective for incentivizing SMEs, while Xu et al. (2025) demonstrate dual incentive effects arising from tax-subsidy combinations. Firm heterogeneity has emerged as a consistent theme: state-owned firms and SMEs are more responsive to green taxes (Huang et al., 2025), and pollution-intensive enterprises see greater improvements in green total factor productivity (Guan et al., 2023). Xie and Zhou (2025) find that green subsidies tend to stimulate exploratory innovation, whereas pollution levies reinforce exploitative strategies. Chai et al. (2025), using macro-simulation, affirm the synergistic role of carbon taxation and clean technology advancement in promoting both environmental and economic performance.

Chinese scholarship, by contrast, emphasizes institutional alignment and firm-level behavioral mechanisms, particularly in relation to environmental and resource tax reforms. Research indicates that green taxes incentivize innovation by creating cost pressure, increasing managerial environmental awareness, and encouraging efficient resource allocation (Huang et al., 2025; Li & Wang, 2024). Recent studies have shifted from normative theorization to empirical evaluation of firm–policy interaction. Bai (2024) identifies stronger green tax responsiveness among capital-intensive and state-owned firms, while Zhang et al. (2024) show that innovation subsidies alleviate tax-induced financial burdens and improve R&D efficiency. Other scholars have introduced evolutionary game models to simulate how taxes—e.g., water levies—affect corporate green strategies through inter-firm cooperation (Cheng et al., 2024). These findings collectively illustrate how green taxation, when institutionally embedded, can reshape corporate behavior and foster policy-aligned innovation pathways.

Despite the richness of the literature on policy instruments, incentive mechanisms, spatial heterogeneity, and analytical methods, several critical gaps persist. First, the existing literature remains fragmented, lacking a unified knowledge architecture (Nobanee & Ullah, 2023). Second, most studies are based on cross-sectional analysis, without adequate attention to temporal dynamics or paradigm evolution (Xu et al., 2025). Third, there exists a notable structural disconnect between Chinese and international literature, with few comparative studies situated within shared institutional frameworks—limiting theory transfer and policy translation (Okombi & Ndoum Babouama, 2024).

To address these gaps, this study conducts a systematic bibliometric analysis of Chinese and English literature published between 2000 and 2025 using CiteSpace (version 6.4.R6). The analysis includes co-authorship networks, institutional affiliations, keyword co-occurrence, thematic clustering, burst detection, and time evolution mapping (Chen, 2006). To improve contextual relevance and policy interpretation, the study incorporates grey literature such as legislative notes, policy reforms, and performance evaluations issued by Chinese agencies and international bodies including OECD, UNEP, IMF, and the World Bank. While grey literature is not peer-reviewed, it provides critical insights into policy design logic, implementation pathways, and institutional feedback mechanisms (Xu, 2024).

Based on this methodological framework, the study addresses four guiding questions: (1) What thematic convergences and divergences exist between Chinese and international studies on green tax and innovation? (2) How have these themes evolved over time under varying policy contexts? (3) What systematic differences exist in theoretical foundations, methodological preferences, and institutional perspectives across contexts? (4) What key issues and cross-scale mechanisms should guide future research for deeper theoretical integration and methodological innovation?

This research aims to bridge academic and policy domains by constructing a comparative knowledge framework for green taxation and business innovation across Chinese and international contexts. Through the integration of grey literature, it enhances institutional explanatory power and reinforces the real-world relevance of scholarly analysis. Ultimately, the paper proposes a three-tier conceptual framework—linking macro-level policy incentives, meso-level industrial responses, and micro-level firm behavior—to illuminate the structural dynamics of green taxation. This framework offers both theoretical coherence and practical insight for implementing China's dual-carbon strategy and advancing global sustainability goals.

Literature Collection and Biblionmetric Visualization Design

Data Sources

Academic Literature

To ensure both data representativeness and analytical rigor, this study systematically collected core literature on "green taxation" and "enterprise technological innovation" from internationally and nationally recognized academic databases. The English-language corpus was obtained from the Web of Science Core Collection (WoS), curated by Clarivate Analytics, which includes high-impact SSCI and SCI journals and is widely regarded as an authoritative source for global bibliometric research (Clarivate Analytics, n.d.). The Chinese corpus was sourced from the China National Knowledge Infrastructure (CNKI), restricted to entries within the Peking University Core Journals Directory and the CSSCI index to ensure academic quality and policy relevance (Yao et al., 2023).

For the English sample, an advanced topic search strategy was applied. Keywords related to green taxation included "green tax*", "environmental tax*", "eco tax*", "carbon tax*", "pollution tax*", "resource tax*", "green fiscal policy", and "green tax reform". Keywords related to technological innovation included "technological innovation", "green innovation", "eco-innovation", "innovation investment", "corporate innovation", "R&D",

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue V May 2025

"technology transfer", and "innovation output". The two keyword sets were combined using the Boolean operator AND, with the time frame limited to 2000–2025. The initial query yielded 501 results, from which 182 documents were retained after removing duplicates and non-relevant items.

The Chinese sample was built using CNKI's advanced search logic. Keywords related to green taxation included: "绿色税收" (green tax), "环境税" (environmental tax), "资源税" (resource tax), "生态税" (ecological tax), "碳税" (carbon tax), "污染税" (pollution tax), "环境保护税" (environmental protection tax), "绿色税制" (green tax system), and "环境税制改革" (environmental tax reform). Keywords related to technological innovation included variants of "技术创新" (technological innovation), "企业研发" (enterprise R&D), "创新能力" (innovation capacity), and "绿色创新" (green innovation). A total of 441 records were initially retrieved, with 153 core documents retained after manual filtering and relevance screening.

To visualize the spatial distribution of the sample, this study generated a global publication density map based on the "country/region" metadata from WoS (see Figure 1). In this figure, dot size indicates the volume of publications, while color intensity reflects literature density. The map illustrates a global research landscape centered in Europe and the United States, with China emerging as a prominent contributor. This distribution underscores the international diffusion of research attention and reflects contextual variations in policy regimes and academic priorities—providing a basis for comparative analysis in subsequent sections.

Grey Literature

In addition to peer-reviewed academic publications, this study incorporates a curated selection of authoritative grey literature to enhance contextual relevance and policy insight. As summarized in Table 1, these sources include legislative documents, reform plans, institutional reports, and strategy papers issued by international organizations (e.g., United Nations, European Union, OECD, IMF, World Bank) and domestic agencies (e.g., China's Ministry of Finance, the Standing Committee of the National People's Congress, and the State Council).

These documents encompass international agreements, regulatory frameworks, strategic guidelines, and empirical modeling outputs—providing a multidimensional view of fiscal instruments, carbon pricing mechanisms, incentive structures, and regional governance practices.

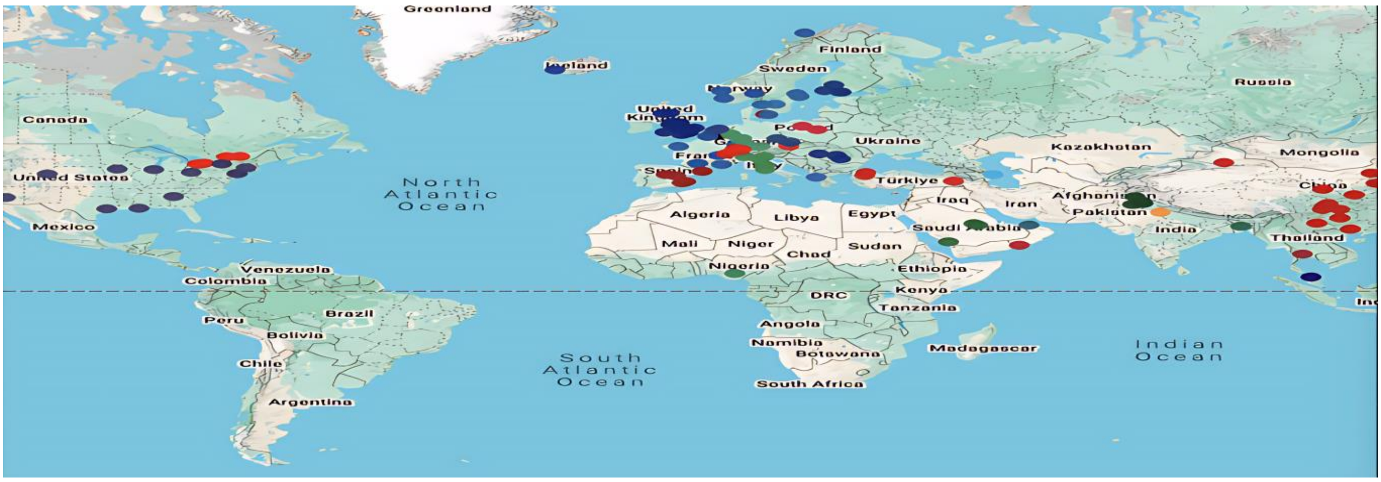

Figure 1. Global Distribution of Publications on Green Taxes and Corporate Technological Innovation (2000–2025)

Note: Based on country/region metadata from Web of Science. Dot size reflects publication volume; color intensity represents literature density. Visualization generated with CiteSpace 6.4.R6.

Selection criteria emphasized policy authority, thematic alignment, and consistency with the 2000–2025 timeframe. Relevant content was extracted on topics such as tax instrument architecture, institutional layering mechanisms, regional pilot outcomes, and feedback pathways. These grey sources supported the interpretation of bibliometric results and reinforced mechanism validation. The comparative reading of academic and policy texts enhances institutional embeddedness and improves the explanatory depth of the theoretical framework—minimizing risks of conceptual abstraction or policy disconnection (Xu, 2024).

Scientometric and Mapping Methodology

This study employs scientometric analysis, supported by visualization techniques, to systematically map the intellectual structure, evolutionary trajectories, and paradigm shifts in the field of green taxation and corporate technological innovation. The core analytical tool is CiteSpace version 6.4.R6, developed by Professor Chen of Drexel University, widely used in bibliometric and scientific knowledge mapping (Chen, 2006).

Key parameters were configured as follows: the analysis period was set from 2000 to 2025; time slicing was performed annually; node types were defined as “keywords”; and the top 50 high-frequency keywords were selected to construct co-occurrence networks. Default pruning algorithms—including Pathfinder and Minimum Spanning Tree (MST)—were applied to filter the network. Cluster labels were generated using the Log-Likelihood Ratio (LLR) method, with clustering quality evaluated by Modularity Q and Silhouette scores.

Visualization outputs include: (1) keyword co-occurrence networks, (2) thematic clustering diagrams, (3) keyword time-evolution paths, (4) burst term detection charts, (5) co-authorship collaboration networks, and (6) institutional collaboration networks.

To improve analytical robustness and policy interpretability, this study also applies an institutional validation mechanism. Specifically, the timing, systemic constraints, and policy feedbacks identified in grey literature are cross-referenced with bibliometric results to verify emerging themes and relational structures. This integrative approach enhances empirical support for institutional adaptability and the practical relevance of scholarly models.

Table 1. Summary of Grey Literature (2000–2025)

No.	Title / Issuing Institution	Document Type	Summary of Citation Context in Text
1	United Nations Environment Programme (UNEP, 2021)	International Organization Report	Chapter 1: Background on global green transition.
2	European Commission (2021), Guidelines on Environmental Tax Reform	International Policy Document	Introduced institutional principles of EU green taxation.
3	Regulation (EU) 2023/956 (CBAM)	Official EU Regulation	Emphasized the role of carbon border adjustment mechanisms.
4	U.S. Inflation Reduction Act (Congressional Research Service, 2022)	U.S. Policy Interpretation Report	Explained U.S. green tax framework and instruments.
5	OECD (2024, 2025), Green Fiscal Incentive Chain Reports	International Organization Report	Cited cases on fiscal systems in Japan and South Korea.
6	International Monetary Fund (IMF, 2023)	International Policy Evaluation Report	Referenced fiscal reforms in India and South Africa.
7	World Bank (2023, 2024)	International Policy Analysis Report	Frequently cited for evaluating green tax tools and global practices.
8	Central Committee of the CPC & State Council (2024), 14th Five-Year Plan	National Strategic Policy Document (China)	Outlined China's green fiscal policy agenda.
9	United Nations Framework Convention on Climate Change (2015)	International Agreement	Cited in reference to peak research activity in Phase III.
10	European Commission (Multiple Years)	Official EU Policy Documents	Frequently referenced for classifying policy evolution stages.
11	OECD (2017, 2022), Report Series	International Modeling Research Report	Cited in discussions on theoretical frameworks and methodological development.
12	State Council of China (2012), National Ecological Civilization Strategy	National Guiding Document	Referenced as a turning point in the second research phase.
13	National People's Congress Standing Committee (2016), Environmental Protection Tax Law – Legislative Notes	Chinese Legislative Document	Provided empirical foundation for domestic literature.
14	State Council of China, Related Tax Reform Documents	Policy and Institutional Reform Files	Cited in sections discussing contextual background of Chinese cases.

Note: Summarizes policy reports and legislative documents on green taxation and innovation from Chinese and international institutions (2000–2025). Standardized citations reflect issuing body and year.

Visualization And Comparative Mapping of Chinese and International Research on Green Taxation and Technological Innovation

Annual Publication Trends and Temporal Evolution

The annual volume and trajectory of publications serve as key indicators of a field's intellectual vitality and responsiveness to policy developments (Su et al., 2024). To examine how academic attention has evolved regarding green taxation and corporate technological innovation, this study visualizes annual publication trends for both Chinese (153 articles) and English (182 articles) samples using data extracted via CiteSpace and plotted in Microsoft Excel. This visualization captures inflection points and periodization in research evolution.

As illustrated in Figure 2, both Chinese and international literatures demonstrate consistent year-on-year growth, punctuated by distinct shifts in thematic and methodological focus. The earliest English-language contribution—Sandén and Azar (2005)—explored synergies between carbon taxes and technology policy. In China, Chen (2004) introduced eco-taxation as a dual-purpose institutional tool for environmental compensation and innovation promotion, signaling the entry of green taxation into Chinese academic discourse.

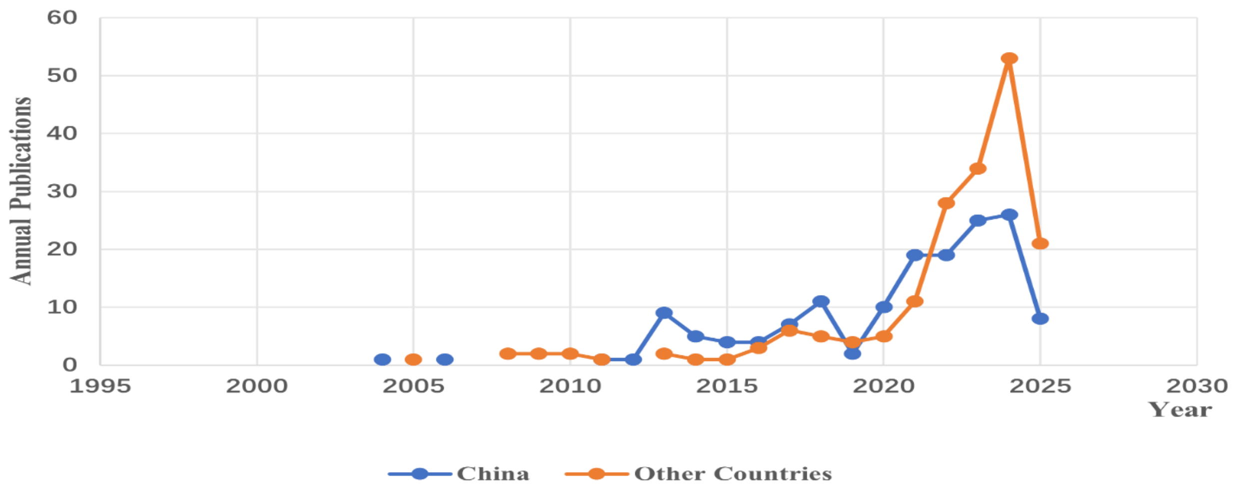

Figure 2. Annual Trends in Green Taxation and Technological Innovation Research (2000–2025)

Note: Trends based on CiteSpace-processed data from CNKI (Chinese) and WoS (English). X-axis: publication year; Y-axis: article count.

Drawing on temporal patterns and paradigm shifts, this study categorizes the field's evolution into three distinct phases:

Phase I (2000–2012): Policy Experimentation and Conceptual Formation In this early stage, publication activity remained limited (fewer than 10 articles annually), with fragmented topics and underdeveloped theoretical systems. Although green tax regimes were launched in Europe and the U.S. earlier, academic visibility was limited due to conceptual overlap with broader environmental policy debates and indexing constraints (Nobanee & Ullah, 2023).

International literature emphasized macro–micro incentive mechanisms grounded in neoclassical welfare economics and optimal taxation theory (Sandén & Azar, 2005; Hart, 2008; Grimaud & Rouge, 2008; Shittu & Baker, 2010), laying the groundwork for the "institutional tools–resource incentives–behavioral response" model.

In China, the focus was on feasibility analysis and institutional logic surrounding eco-tax reforms. Scholars such as Chen (2004), Zhao (2006), Zhou and Nie (2011) explored legal legitimacy, policy structure, and legislative viability. Theoretical frameworks were predominantly derived from public finance and institutional economics, lacking causal inference or empirical modeling.

Methodologically, English studies employed cost–benefit analysis, CGE models, and exploratory simulations. Chinese research relied on normative argumentation and interpretive analysis, constrained by limited data availability and underdeveloped tax infrastructure.

Phase II (2013–2019): Mechanism Construction and Empirical Deepening This phase marked an acceleration in publication output and methodological maturity. Globally, momentum was shaped by the Paris Agreement (2015) and carbon pricing reforms, while in China, the "ecological civilization" policy (2012) and enactment of the Environmental Protection Tax Law (2016) catalyzed empirical inquiries (State Council, 2012; NPCSC, 2016).

International studies focused on institutional interactions and uncertainty mitigation. Desmarchelier et al. (2013) used agent-based simulations to model path dependency in policy diffusion. Zhou et al. (2016) and Samad & Manzoor (2015) examined structural lag effects of carbon taxes using panel data models. Research converged around the synergistic effects of green taxes, subsidies, and financial instruments.

Chinese scholarship adopted econometric approaches (e.g., DID, GMM, threshold regressions) to validate Porter's hypothesis and analyze policy heterogeneity. Studies by Yu (2018), Meng and Han (2017), Xu and Zhou (2014) demonstrated how tax effectiveness varied by region, sector, and competition intensity.

Theoretical progress included the integration of institutional feedback theory, innovation system models, and policy signal credibility (Samad & Manzoor, 2015). Chinese studies drew on the resource-based view, dynamic capabilities, and Porter's hypothesis to model enterprise adaptation (Long et al., 2016).

Methodological advances were observed in both corpora. International work embraced SEM, DSGE, and mixed-methods designs (Desmarchelier et al., 2013; Zhou et al., 2016), while Chinese studies expanded into DEA, spatial econometrics, and game theory (Yu et al., 2019; Bi & Yu, 2019).

Phase III (2020–2025): Performance Integration and Cross-Scale ModelingIn recent years, research has moved toward integrated performance evaluation and multi-level system modeling. Since 2022, international publication output has outpaced Chinese studies, driven by reforms such as the EU's CBAM and the U.S. Inflation Reduction Act (EU, 2023; Congressional Research Service, 2022).

English literature increasingly views green taxation as a systemic lever for achieving carbon neutrality and industrial transformation. Ajayi & Reiner (2020) and Karmaker et al. (2021) modeled cross-scalar linkages between institutional incentives and technological adoption. OECD (2024) combined life cycle assessment (LCA) with input–output models to evaluate fiscal impacts.

Chinese studies emphasize national strategies such as the dual-carbon framework and digital governance. Scholars like Wang & Fan (2021), Zhu (2023), and Bian et al. (2023) used spatial regressions and DEA–SBM models to measure innovation efficiency and regional spillovers.

Theoretically, international literature incorporates complex adaptive systems (CAS), multilevel governance (MLP), and path dependence frameworks to model institutional embedding (Ajayi & Reiner, 2020; Desmarchelier et al., 2021). Chinese work integrates evolutionary game theory, new economic geography, and Porterian logic to explain behavioral adaptation (Tian, 2020; Liu et al., 2023).

Methodologically, system integration now dominates. English studies apply ABM, system dynamics (SD), DSGE, and synthetic control methods (SCM) (OECD, 2022; Ajayi & Reiner, 2020). Chinese literature merges machine learning, spatial econometrics, and simulation with conventional DID–GMM approaches (Mi & Zhang,2020; Zhu, 2023; Bian et al., 2023).

In summary, research on green taxation and enterprise innovation has undergone a three-phase evolution: from policy experimentation, to mechanism construction, to performance optimization. This shift from conceptual theorization to empirical modeling and cross-scale governance reflects the field's methodological maturation and institutional diversification—highlighting the need for integrative, comparative frameworks to support global policy learning and theoretical advancement.

Core Author Analysis and Collaboration Network Mapping

In the field of green taxation and corporate technological innovation, the formation of core author groups and the density of collaborative networks reflect the structural concentration of knowledge production and the extent of academic synergy (Zheng & Li, 2025). High-output authors often serve as intellectual leaders, while cohesive networks signal effective knowledge diffusion and interdisciplinary exchange. Utilizing CiteSpace (version 6.4.R6) with "author" as the node type, this study visualizes and statistically evaluates author collaboration networks across Chinese and English literature samples. High-frequency authors and emergent contributors were further identified and analyzed using Microsoft Excel.

Table 2. Top Ten Most Productive Authors in the English Sample (2000–2025)

Publication Count	Publication Year	Author Name	Publication Count	Publication Year	Author Name
3	2023	Farooq U	2	2023	Guan H G
3	2021	He Y	2	2022	Liu J
3	2021	Zheng H	2	2025	Liu D
2	2021	Xu Y D	2	2022	Li J
2	2024	Bi S H	2	2023	Wang Y

Note: Based on Web of Science data. Sorted by publication volume. Includes author attributes where applicable.

As shown in Table 2, Farooq et al. were the most prolific authors in the English dataset, with three publications investigating the multi-dimensional drivers of green innovation. Their work emphasizes how corporate tax rates, environmental regulation, and capital inflows—such as foreign direct investment (FDI), development aid, and remittances—shape firm-level environmental outcomes. Other notable contributors, such as He et al. and Zheng et al., focus on how fiscal instruments influence innovation performance via mediating and moderating mechanisms.

No burst authors were detected under the settings (minimum duration = 1 year; burst intensity > 0.5). Given the publication ceiling of three, the Price's Law threshold (1.3) did not meet the standard benchmark of 1.5 (Cui & Xu, 2025). Therefore, this study defines core authors as those with at least two publications, resulting in 28 high-productivity authors who collectively account for 59 publications—32.42% of the total English sample. However, author collaboration remains sparse, and stable trans-institutional research alliances have yet to emerge.

In the Chinese literature (see Table 3), Yu et al. lead with six publications, employing empirical methods such as quasi-natural experiments and difference-in-differences (DID) models to examine the effects of environmental tax reforms on firm behavior, green transformation, and innovation performance. Other active contributors—including Bi, Chu, and Bian—focus on the synergistic effects of carbon taxes, emissions trading, and fiscal subsidies. These authors frequently utilize evolutionary game theory and simulation techniques to explore strategic responses.

Table 3. Top Ten Most Productive Authors in the Chinese Sample (2000–2025)

Publication Count	Publication Year	Author Name	Publication Count	Publication Year	Author Name
6	2018	Yu L C	4	2022	Huang J Q
6	2018	Bi Q	3	2021	Liu Y
5	2021	Chu Z P	3	2017	Meng F S
5	2021	Bian C	3	2018	Zhang W G
4	2021	Sun Z L	3	2021	Wang H

Note: Based on CNKI data. Sorted by publication volume. Includes author attributes where applicable.

Five emergent authors—Han, Meng, Bi, Yu, and Sun—were identified under the same burst detection parameters. Han and Meng's team, in particular, emphasize the nonlinear effects of environmental policies and frequently employ evolutionary modeling to simulate response paths.

Applying the Price's Law threshold of 1.83, this study identifies 19 core authors with at least two publications. Collectively, they contributed 62 papers, accounting for 40.52% of the Chinese sample. Despite overlapping research themes, inter-author collaboration remains weak, suggesting a lack of cross-institutional integration.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue V May 2025

A comparative analysis reveals that both datasets are characterized by fragmented author networks and low-density collaboration. English-language research tends to focus on institutional synergies and performance pathways (He et al., 2022; Farooq, 2023), whereas Chinese research shows a dual-paradigm approach combining econometric validation and evolutionary simulation (Sun et al., 2021; Yu et al., 2023). Notably, international collaboration remains underdeveloped, limiting global comparative research on green taxation.

Institutional Collaboration and Network Structure Analysis

Institutional affiliations play a critical role in shaping the knowledge production structure and the diffusion dynamics of green taxation and innovation research (Zheng & Li, 2025). Using CiteSpace with "institution" as the node type, this study maps institutional collaboration networks and identifies key institutions based on publication volume and network centrality.

Table 4. Top Five Most Productive Institutions in the English Sample (2000–2025)

Publication Count	Centrality	Institution Name	Type of Institution	Location
6	0.12	State University of New York	University	New York, United States
5	0.08	University of London	University	London, United Kingdom
5	0.08	Chinese Academy of Sciences	Research Institute	Beijing, China
4	0	Shandong University of Finance & Economics	University	Shandong, China
4	0.06	The University of Sydney	University	Sydney, New South Wales, Australia

Note: Based on Web of Science data. Sorted by publication volume. Includes institutional attributes where applicable.

According to Table 4, the State University of New York ranks first with six publications, followed by the University of London, Chinese Academy of Sciences, Shandong University of Finance and Economics, and the University of Sydney. These institutions focus primarily on carbon and resource taxation mechanisms. Methodologically, they often adopt Porter’s hypothesis, mediation models, and eco-macroeconomic simulations to assess the influence of tax tools on innovation performance.

Universities dominate the English dataset, with institutional affiliations concentrated in developed economies. SUNY demonstrates both high publication volume and strong network centrality, indicating its role as both a knowledge producer and integrator. In contrast, Shandong University of Finance and Economics shows high output but low centrality, reflecting strong internal collaboration but limited external influence. The institutional network contains 255 nodes and 297 links, with a density of only 0.0092—well below CiteSpace’s 0.1 benchmark—indicating sparse inter-institutional collaboration (Liu, 2024).

Table 5. Top Five Most Productive Institutions in the Chinese Sample (2000–2025)

Publication Count	Centrality	Institution Name	Type of Institution	Location
15	0.06	Northeastern University (China)	University	Shenyang, Liaoning, China
10	0.11	Xiamen University	University	Xiamen, Fujian, China
7	0.03	Southwest University	University	Chongqing, China
5	0	Hohai University	University	Nanjing, Jiangsu, China
5	0.03	Capital University of Economics and Business	University	Beijing, China

Note: Based on CNKI data. Sorted by publication volume. Includes institutional attributes where applicable.

In China (see Table 5), Northeastern University leads with 15 publications, followed by Xiamen University (10), Southwest University (7), and both Hohai University and Capital University of Economics and Business (5 each). These institutions primarily examine the performance of policy tool combinations—such as carbon taxes, trading schemes, and green credit—on firm-level green R&D efficiency. Commonly used methods include DID, evolutionary game models, and threshold regression.

Most research is conducted by universities located in China's economically advanced eastern coastal provinces. Xiamen University stands out with high centrality and wide regional influence, whereas Hohai University exemplifies the "high-output, low-centrality" model, characterized by strong internal cohesion and limited external collaboration. The Chinese institutional network comprises 67 nodes and 90 links, yielding a collaboration density of 0.0407—higher than the English sample, but still indicating limited cross-institutional integration (Liu, 2024).

In summary, both corpora exhibit "university-led, regionally concentrated, and loosely connected" institutional structures. English-language studies feature more transnational collaboration, whereas Chinese research remains regionally clustered with stronger internal cohesion. These structural divergences mirror broader contrasts in institutional integration and research focus (Zhao et al., 2024; Hu & Guo, 2025). The limited structural synergy across datasets underscores the need for enhanced international collaboration to facilitate cross-border knowledge transfer and global convergence in green tax research (Farooq, 2024).

Research Hotspots in Green Taxation and Technological Innovation

Keyword Co-occurrence Analysis

To systematically identify core research themes and structural patterns within the field of green taxation and enterprise technological innovation, this study conducts keyword co-occurrence and clustering analyses using CiteSpace version 6.4.R6. Keywords represent thematic focus; their frequency reflects scholarly attention (Ba et al., 2025), while betweenness centrality measures their bridging role in linking conceptual clusters within the knowledge network (Li et al., 2024). High-frequency keywords indicate dominant discourses, whereas high-centrality terms highlight cross-cutting knowledge nodes.

Terminological normalization was applied across Chinese and English samples. Expressions such as "green R&D," "eco-innovation," and "low-carbon innovation" were consolidated under the unified label "green innovation." Key distinctions were maintained between "green total factor productivity (Green TFP)," "green technological innovation," and "green upgrading," representing different dimensions within the innovation performance framework.

Keyword co-occurrence matrices were generated for the 2000–2025 period and refined by merging synonymous terms. The final results are presented in Table 6, which captures both keyword prominence and conceptual connectivity. Centrality values reflect the original unmerged network topology, as merged networks distort centrality indices.

Table 6. Top 30 High-Frequency Keywords in Chinese and English Samples (2000–2025)

Key words(Other Countries)	Frequency	Key words(China)	Frequency
environmental protection tax	51	green taxation	59
impact	46	green innovation	35
green innovation	46	technological innovation	22
policy	39	environmental regulation	17
technological innovation	39	carbon tax	15
research and development	30	evolutionary game	15
performance	30	green transformation	10
economic growth	28	R&D investment	8
emissions	27	tax incentives	8
total factor productivity	26	carbon emission reduction	8
environmental regulation	23	sewage charge	7
energy	22	green total factor productivity	6
carbon tax	20	poner hypothesis	6
china	16	enterPrise innovation	5
technology	15	mediating effect	4
model	12	environmental investment	3
competitiveness	11	fee to tax	3
regulations	11	tax administration	3
environmental policy	10	water tax	3
management	10	carbon trading	2
porter hypothesis	10	difference-in-differences model	2
determinants	9	environmental performance	2
firms	9	esg performance	2
pollution	9	resource tax	2
strategy	9	low carbon technology	2
climate change	8	ecological civilisation	2
incentives	8	double dividend	2
taxes	8	double difference	2
market	8	green credit	2
panel data	8	financing constraints	2

Note: Derived from keyword co-occurrence networks based on CNKI and Web of Science core samples. Frequency indicates thematic intensity; centrality reflects structural importance.

In the English corpus, the top keywords include "environmental protection tax" (51 occurrences), "impact" (46), "green innovation" (46), and "policy" (39). The highest centrality values are associated with "economy" (0.15), "market" (0.14), and "CO2 emissions" (0.13), underscoring the field’s interdisciplinary nature—especially its integration with climate governance, economic modeling, and technological development.

In the Chinese dataset, "green taxation" ranks highest in frequency (59), followed by "green innovation" (35) and "technological innovation" (22). The keyword "environmental tax" holds the highest centrality score (0.46), indicating its conceptual significance in connecting regulatory mechanisms to behavioral and performance outcomes. Additional high-frequency terms such as "evolutionary game," "fee-to-tax," and "carbon trading" reveal a strong research emphasis on institutional reform and behavioral adaptation in the Chinese context.

In summary, both corpora share a dual-core thematic structure centered on taxation and innovation. However, international research tends to emphasize systemic policy assessment and cross-sectoral modeling, while Chinese scholarship focuses more heavily on micro-level mechanism identification and policy alignment.

Keyword Clustering Analysis

Building on the co-occurrence analysis, keyword clustering was conducted to extract the thematic architecture and temporal evolution of research domains. This process enables a clearer comparison of structural trends across Chinese and English literature.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue V May 2025

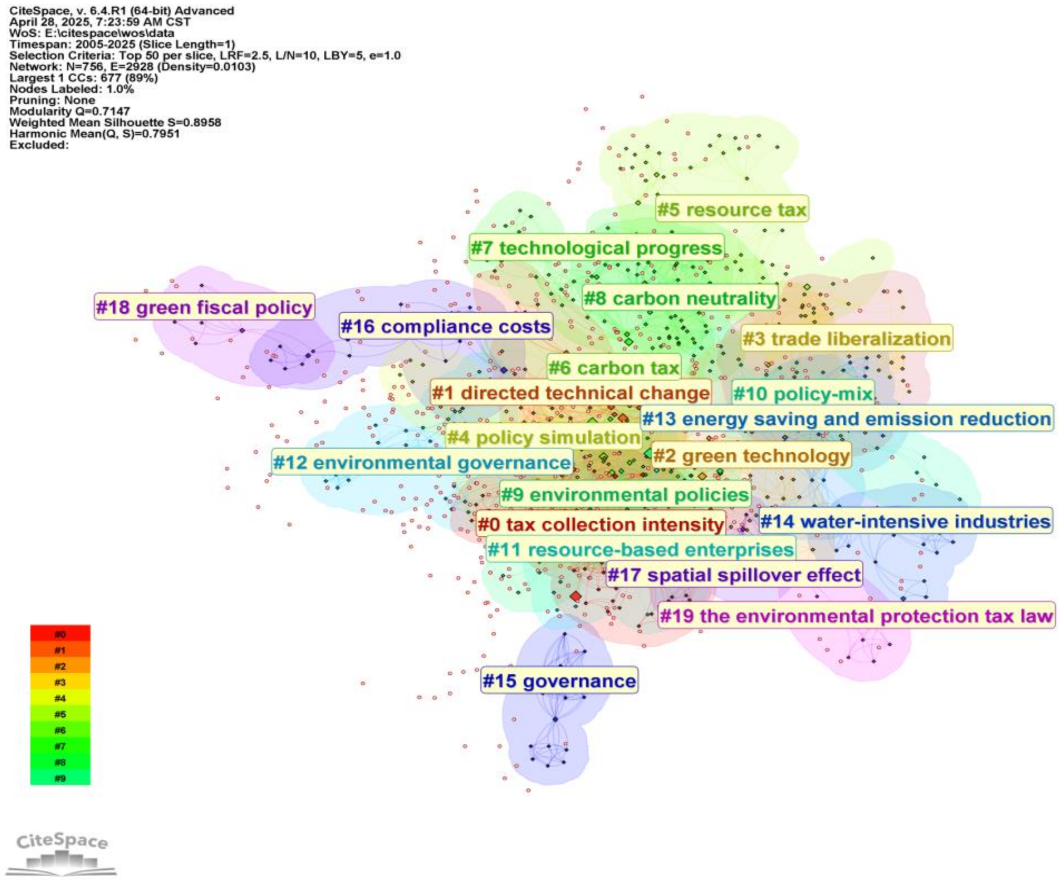

Figure 3. Keyword Clustering Network of English Literature (2000–2025)

Note: Constructed using CiteSpace 6.4.R1. Clusters based on top 50 keywords via LLR algorithm. Q and S scores indicate high-quality clustering (Modularity Q = 0.7147; Silhouette S = 0.8958).

As shown in Figure 3, a total of 20 valid keyword clusters were identified. Key themes include #0 tax collection intensity, #1 directed technical change, #2 green technology, and #3 trade liberalization. The size of Cluster #0 highlights the centrality of fiscal tools in global research on green tax policy mechanisms.

Table 7. Summary of Keyword Clustering Features in English Samples (2000–2025)

Cluster ID	Silhouette	Size	Cluster Name	Top Five Cluster Label Terms Ranked by the Highest Log-Likelihood Ratio (LLR)
#0	0.87	62	tax collection intensity	tax collection intensity (9.46), industrial structure upgrading (9.46), eco-innovation (5.84), policy evaluation (5.84), environmental pollution (4.72)
#1	0.777	53	directed technical change	directed technical change (11.49), patent data (4.15), externality internalization (3.82), climate mitigation(3.82), fuel prices (3.82)
#2	0.923	46	green technology	green technology(10.39), carbon taxes (10.39), carbon emission reduction (10.39), cap-and-trade(5.18), green product r&d (5.18)
#3	0.976	46	trade liberalization	trade liberalization (6.77), growth effect (6.77), micro -enterprise (6.77), welfare (6.77), pollution havens hypothesis(6.77)
#4	0.871	45	policy simulation	policy simulation (11.2), tax(5.91), innovation direction (5.58), directional flow(5.58), agent-based model(5.58)
#5	0.83	44	resource tax	resource tax(17.1), foreign direct investment (11.36), total factor productivity(5.69), cs-ardl (5.66), green environmental innovation (5.66)
#6	0.841	44	carbon tax	carbon tax (10.32), evolutionary game (7.42), low-carbon technology innovation (5.53), innovation subsidy (4.55), policy synergism (4.55)
#7	0.916	41	technological progress	technological progress(12.33), difference-in-differences method (12.33), carbon tax recycling (6.14), environmental law enforcement (6.14), land green useeffciency(6.14)
#8	0.935	40	carbon neutrality	carbon neutrality(10,0.005), uncertainty(6.84,0.01), social preferences(6.84,0.01), cup-fm(6.84,0.01), natural resource senvironmental tax(6.84.0.01)
#9	0.875	37	environmental policies	environmental policies (9.56), policy(5.93), fintech (4.77), corporate governance (4.77), stock-flow consistent model (4.77)
#10	0.864	37	policy-mix	policy-mix(7.48), green technologies (7.48), r&d(6.4) green growth & sustainability transition (6.4), did model (6.4)
#11	0.883	33	resource-based enterprises	resource-based enterprises(6.19), gmm-did (6.19), technology sharing(6.19), trade credit (6.19), market competitiveness(6.19)
#12	0.964	29	environmental governance	environmental governance (14.91), heavily polutingindustries (7.41), intelligent transformation (7.41), energy conservation and emission reduction (7.41), synergistic emission reduction (7.41)
#13	0.922	26	energy saving and emission reduction	energy saving and emission reduction (6.71), industrialupgrading (6.71), environmental quality (6.71), energy intensity(6.71), business strategy analysis (6.71)
#14	0.964	20	water-intensive industries	water-intensive industries (7.6), financial performance(7.6), micro environmental performance(7.6), sustainable growth (7.6), firm esg (7.6)
#15	0.987	18	governance	governance (8.2), small and medium enterprises (sme), financial constraints(8.2), finance (8.25), instmuments(8.2), economic indicators(8.2)
#16	0.926	17	compliance costs	compliance costs (15.1), r&d investment (9.65), environmental protection tax reform (7.5), difference-in-differences (did)(7.5), greenwashing (7.5)
#17	0.951	16	spatial spillover effect	spatial spillover effect (9.51), duopoly (9.51), environmental protection tax act (9.51), emission tax(9.51), risk (9.51)
#18	0.987	10	green fiscal policy	green fiscal policy (10.4), carbon mitigation (9.51), green investment (9.51) innovation compensation (9.51), pollution and carbon reduction(6.76)
#19	1	8	the environmental protection tax law	the environmental protection tax law(7.38), value effect(7.38), op method (7.38), economic effect (7.38), heavily polluting enterprises (6.34)

Note: Cluster labels generated via LLR algorithm. Includes cluster size, mean year, and representative terms. Cluster IDs correspond to visualization figures.

The English clusters (see in Table 7) can be categorized into five thematic directions:

(1) Green Taxation and Policy Instruments (#0, #5, #6, #18, #19)

These clusters examine the impact of fiscal tools—including environmental taxes and carbon pricing—on firm behavior and industrial transformation. Scholars such as Yuan (2024) and Li et al. (2024) highlight the improvement of green TFP through pollution tax reform, while Xu et al. (2025) investigate the integrated effects of macro-financial instruments and carbon markets.

(2) Green Technology and Enterprise Transformation (#1, #2, #7, #11)

This group focuses on the interaction between tax incentives and technology diffusion. Lennox & Witajewski-Baltvilks (2017) analyze the sensitivity of capital-intensive technologies to carbon taxation, while

Chai et al. (2025) emphasize the synergistic role of fiscal tools and clean energy technologies in firm-level green transition.

(3) Carbon Neutrality and Emissions Policies (#8, #13, #14, #17)

These clusters emphasize coordination between environmental taxation, innovation subsidies, and emission reduction targets. Rengs et al. (2020) explore the employment co-benefits of carbon tax revenue recycling, and Xu et al. (2023) investigate spatial spillover effects in pollution control policies.

(4) Environmental Governance and Policy Mix (#4, #9, #10, #12, #15, #16)

This theme examines governance models integrating multiple policy tools. Studies by Sun et al. (2023) and Wang et al. (2024) show the limitations of single-instrument approaches in complex industries. Other works (e.g., Hu et al., 2023; Tingbani et al., 2023) address risks such as policy-induced innovation constraints and greenwashing.

(5) Green Trade and Global Adaptation (#3)

Focusing on globalization, this cluster explores trade liberalization, pollution haven effects, and institutional fragility. Hamaguchi (2023) critiques green tax efficacy in corrupt environments, while Liu et al. (2023) and Zhao et al. (2022) stress safeguarding innovation under institutional transition conditions

By contrast, the Chinese keyword clustering network (see in Figure 4) exhibits high structural clarity, with a modularity score of 0.739 and a silhouette coefficient of 0.9201—indicating strong topical differentiation and internal coherence (Deng et al., 2023). A total of 11 clusters were identified, reflecting major themes such as #0 environmental tax, #1 technological innovation, and #2 carbon neutrality (see Table 8 for details). Cluster #0 dominates in size, underscoring the foundational role of green taxation in Chinese academic discourse. The close interconnections and partial overlaps among clusters suggest an integrated and cross-referential knowledge architecture.

Three major thematic categories (see in Table 8) emerge from the Chinese clustering structure:

(1) Green Tax System and Policy Tool Evolution (#0, #4, #7, #9)

This theme includes topics such as environmental protection tax, water resource tax, and collaborative development frameworks. Liu & Zhou (2025) emphasize the dual dividend of pollution reduction and economic growth under appropriate structural conditions. Zhou & Qi (2024), Cheng et al. (2024), and Yang & Li (2024) analyze how resource tax reforms reshape corporate incentives for green innovation.

(2) Green Innovation Drivers and Enterprise Transformation (#1, #5, #10, #14)

These clusters center on technological innovation, evolutionary game theory, and green TFP. Han and Yan (2023) show that environmental taxation enhances green TFP via improvements in innovation and efficiency. Liu et al. (2023) assess post-reform innovation dynamics, while Sun et al. (2021) and Bian et al. (2023) explore the behavioral feedback loops triggered by hybrid instruments such as carbon trading and green credit.

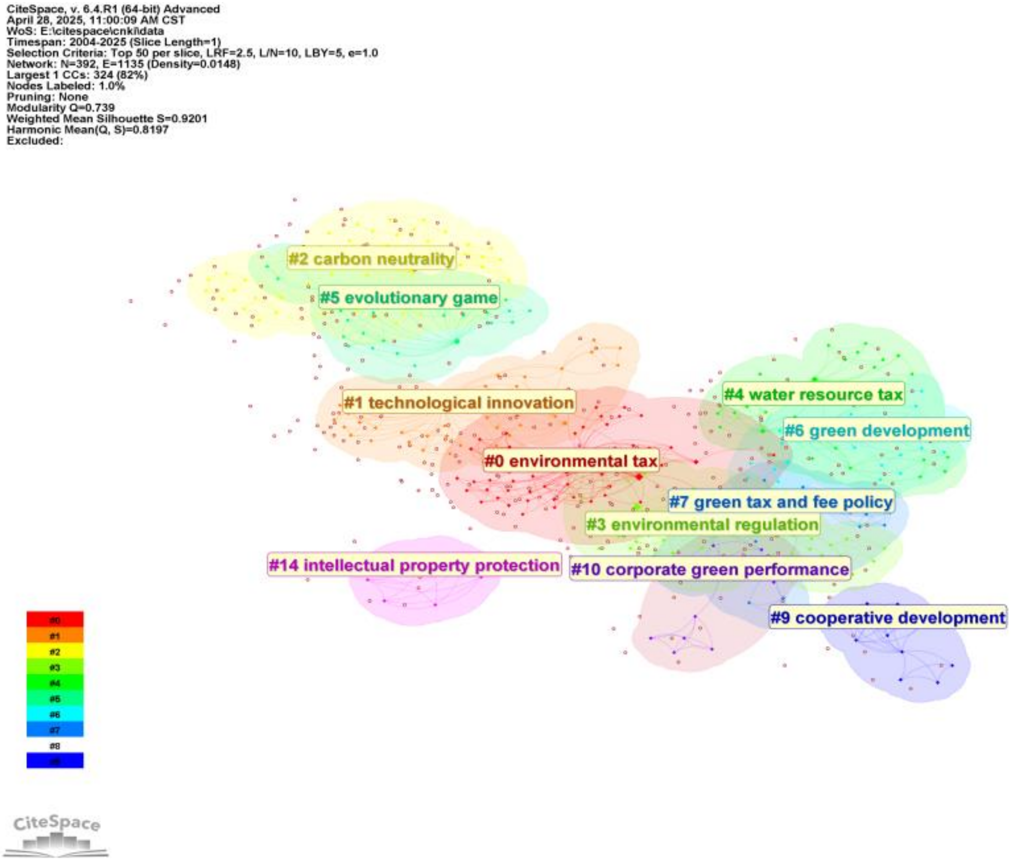

Figure 4. Keyword Clustering Map of Chinese Literature Based on CNKI (2000–2025)

Note: Constructed using CiteSpace 6.4.R1. Clusters based on top 50 keywords via LLR algorithm. Q and S scores indicate high-quality clustering (Modularity Q = 0.739; Silhouette S = 0.9201).

Table 8. Summary of Keyword Clustering Features in Chinese Samples (2000–2025)

Cluster ID	Silhouette	Size	Cluster Name	Top Five Cluster Label Terms Ranked by the Highest Log-Likelihood Ratio (LLR)
#0	0.901	55	environmental tax	environmental tax (19.86), environmental protection tax(15.48), capacity utilization(6.87), innovation subsidy(6.87), green process innovation(3.42)
#1	0.931	45	technological innovation	technological innovation(10.73), difference-in-difference model(7.66), scientific and
#2	0.952	44	carbon neutrality	carbon neutrality(9.87), carbon tax policy (9.87), ocean carbon sink(4.91), international competitiveness(4.91), innovation capability(4.91)
#3	0.845	42	environmental regulation	environmental regulation(13.53), environmental taxes(8.19), green innovation(8.19), corporate social responsibiity(6.44), green credit (6.21)
#4	0.909	32	water resource tax	water resource tax(9.26), green taxation(9.26), R&D ivestment(5.64), green innovation efficiency(5.64), environmental tax (4.61)
#5	0.936	32	evolutionary game	evolutionary game(15.65), carbon trading(10.38), low-carbon technological innovation(10.38), innovation strategy(10.38), informal environmental regulation (9.22)
#6	0.918	25	green development	green technology innovation(10.6), green transformation (10.6), greening tax system(10.6), green development(10.6), environmental legitimacy (5.27)
#7	0.934	20	green tax and fee policy	green tax and fee policy(6.02), tax system reform (6.02), export subsidy(6.02), porter hypothesis(6.02), strategic environmental policy(6.02)
#9	0.995	12	cooperative development	cooperative development(7.07), esg performance(7.07), cash flow(7.07), low-carbon development(7.07), green tax incentive(7.07)
#10	0.975	11	corporate green performance	corporate green performance(8.13), environmental fee-to-tax reform(8.13), environmental performance(8.13), economic performance(8.13), innovation performance(8.13)
#14	0.993	6	intellectual property protection	intellectual property protection(7.71), evolutionarily stable equilibrium(7.71), evolutionarily stable equilibriumm (7.71), incentive-based environmental regulation(7.71), intellectual property protection (7.71)

Note: Cluster labels generated via LLR algorithm. Includes cluster size, mean year, and representative terms. Cluster IDs correspond to visualization figures.

(3) Environmental Governance under the Carbon Neutrality Strategy (#2, #3, #6)

This thematic group highlights terms such as carbon neutrality, environmental regulation, and green innovation. Liu et al. (2022) stress the strategic integration of public–private resources. Huo et al. (2023) examine the behavioral interactions among government, enterprises, and consumers. Cheng & Chen (2021) propose the use of marine carbon sinks as compensatory tools under the dual-carbon policy framework. Spatial spillovers—especially within heavy industries—are frequently noted (Yang et al., 2023; Yu et al., 2021).

Overall, keyword clustering reveals both convergence and divergence in the thematic priorities of Chinese and international research. Shared focal points—such as environmental tax policy, innovation dynamics, and regulatory instruments—underscore a global consensus on green taxation's role in advancing sustainable technological transformation (Wang & Yu, 2023; Feng & Zhang, 2025; Hu & Guo, 2025; Xie & Zhou, 2025).

However, methodological and institutional divergences persist. International research emphasizes cross-policy combinations, carbon-neutral transition frameworks, and fiscal system performance within the global governance context (Mahmood et al., 2022; Sun et al., 2023; Xu et al., 2025). Conversely, Chinese scholarship leans toward empirical identification of micro-incentive effects and institutional evolution, marked by strong policy embeddedness and localized reform tracking (Yang et al., 2024; Huang et al., 2025).

These structural distinctions reflect variations in policy maturity, academic traditions, and institutional frameworks (Zhang et al., 2025). Moving forward, enhanced integration between theoretical modeling and context-sensitive policy design is vital for fostering a unified global research paradigm on green taxation and innovation (Hu & Guo, 2025).

Thematic Evolution Pathways in Green Taxation and Technological Innovation Research

Building on the identification of core research themes, analyzing their temporal evolution offers insights into knowledge dynamics and the phased transformation of scholarly focus. Using CiteSpace 6.4.R6, this section presents keyword timeline maps and burst term visualizations for both Chinese and English literature samples (Figures 5–8). Timeline visualizations capture the continuity and lifespan of clusters, while burst detection highlights emergent topics marked by spikes in keyword frequency (Ding et al., 2025). To enhance interpretability, only the top 10 clusters with silhouette scores above 0.7 are retained (Deng et al., 2023).

As shown in Figure 5, English-language research peaked around 2020, with varying durations and intensities across clusters. Clusters such as #1 (directed technical change), #6 (carbon tax), #7 (technological progress), #8 (carbon neutrality), and #9 (environmental policies) remain active, reflecting their strategic role in climate governance and green transformation agendas. Earlier-emerging clusters like #0 (tax collection intensity), #2 (green technology), and #3 (trade liberalization) began expanding after 2008, focusing on systemic adaptation and regulatory alignment. The more recent rise of #5 (resource tax) reflects a conceptual shift from pure carbon pricing to integrated resource-environmental policy models.

In terms of node characteristics, terms like "technological innovation" and "research and development" were early entries with sustained citation prominence, signaling their foundational role. Keywords such as "environmental regulation," "emissions," "climate change," and "economic growth" also display long-term continuity. From 2015 onward, emerging terms such as "green innovation," "competitiveness," and "pollution" indicate increasing emphasis on firm performance and innovation outcomes.

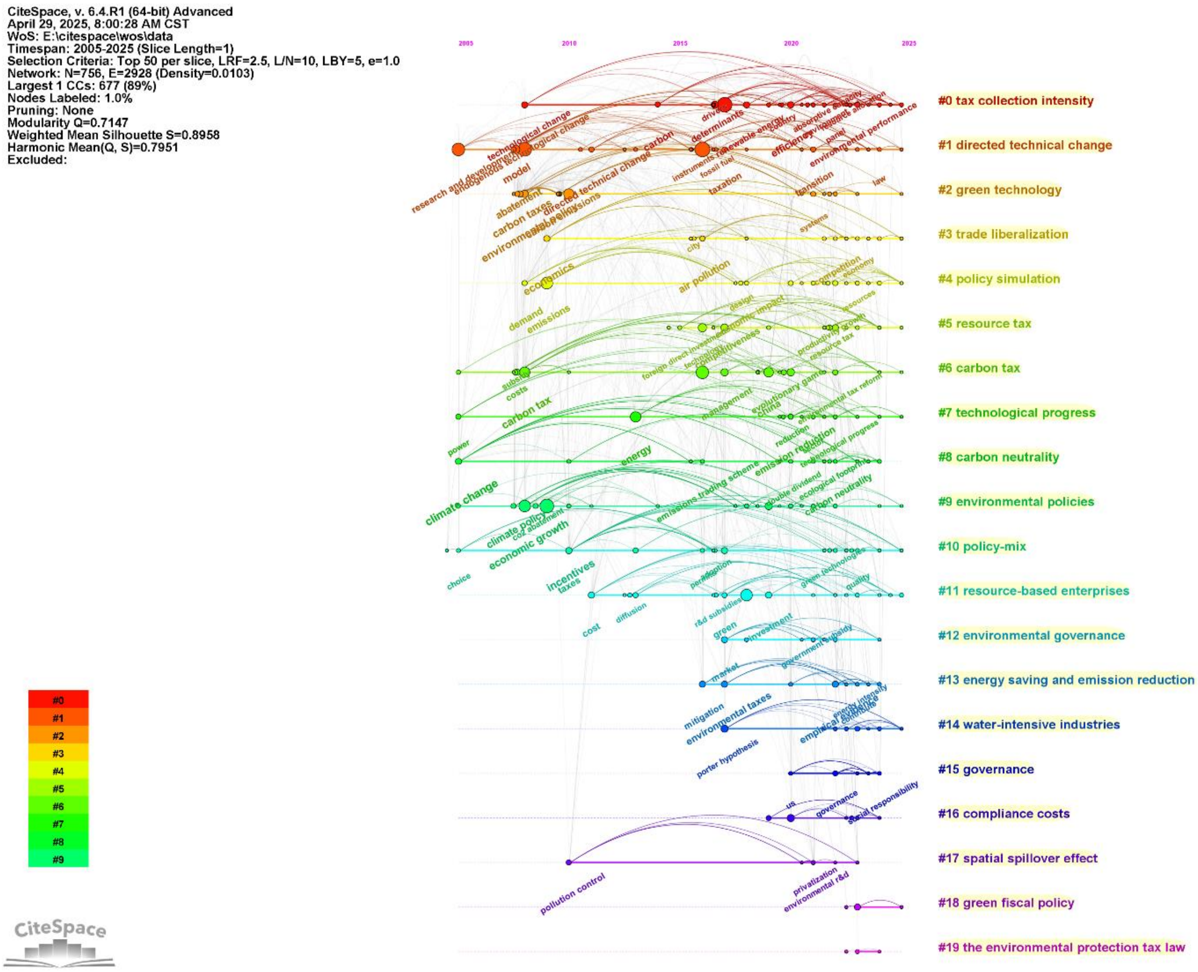

Figure 5. Time Evolution of Research Themes in English Literature on Green Taxation and Corporate Technological Innovation (2000–2025)

Note: Horizontal lines represent keyword clusters; node size indicates frequency. Color/lines depict temporal evolution and topic continuity.

Based on Figure 6, international literature evolves across three major phases:

Phase I (2005–2010): Exploration and Foundation Building Keywords such as “R&D,” “environmental policy,” “costs,” and “abatement” dominate, reflecting foundational work post-Kyoto Protocol. Studies established early models linking carbon taxation, subsidies, and innovation stimuli (Sandén & Azar, 2005; Hart, 2008; Greater et al., 2009).

Phase II (2011–2017): System Construction and Policy Diversification Terms like “taxes,” “directed technical change,” and “energy” reflect expanding fiscal tools and integrated modeling strategies. Triggered by the Paris Agreement, this period saw a rise in policy simulations and fiscal optimization (Aalbers et al., 2013; Shiell & Lyssenko, 2014).

Phase III (2018–present): Performance Assessment and Multiscale Modeling Keywords such as “carbon tax,” “emissions,” and “environmental protection tax” indicate focus on empirical validation and outcome evaluation. Driven by global climate pledges and instruments like the EU Green Deal and U.S. IRA, studies increasingly adopt multiscale models to examine green TFP, firm-level innovation, and policy performance (Karmaker et al., 2021; Chen et al., 2020; Song et al., 2022).

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue V May 2025

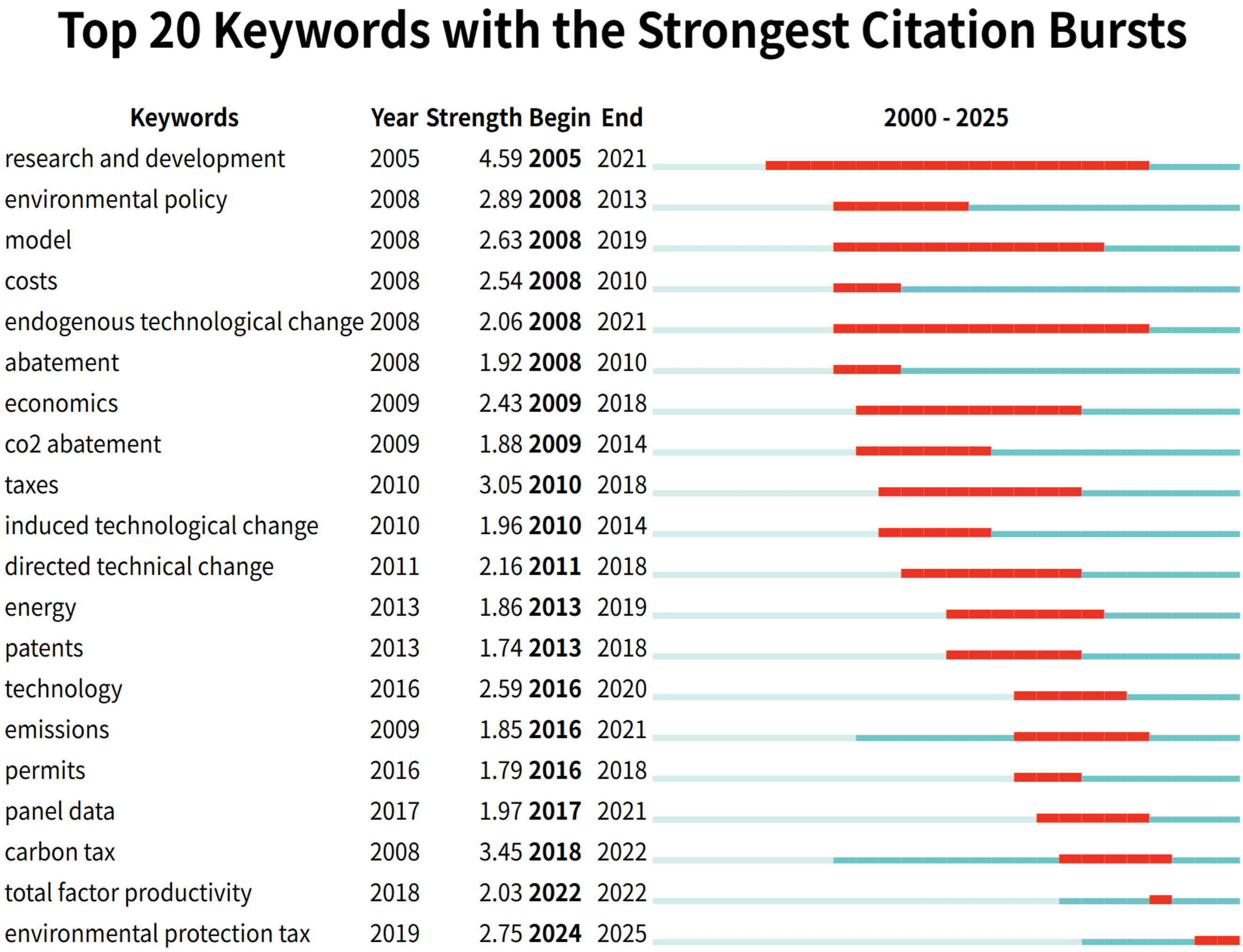

Figure 6. Burst Detection of Keywords in English Literature (2000–2025)

Note: Red bars denote high-frequency emergence periods, indicating dynamic research focus shifts.

As Figure 7 illustrates, Chinese research converges around 2020, reflecting policy momentum from the "dual-carbon" strategy. Cluster #8 (tax system reform) traces institutional restructuring from 2013–2022, focusing on VAT reform and the implementation of the Environmental Protection Tax Law. Following the stabilization of institutional frameworks, research shifted toward evaluating the effectiveness and synergy of specific instruments. Cluster #2 (environmental protection tax) emerged earliest and remains central.

Clusters such as #0 (carbon tax), #1 (environmental tax), #3 (green tax system), #4 (green technological innovation), and #7 (industrial structure rationalization) form a sequential knowledge chain from policy design to enterprise-level response. Their consistent visibility underscores sustained scholarly interest in the structural effects of green tax mechanisms. In recent years, the emergence of clusters like #5 (green innovation), #6 (green taxation), and #10 (environmental accounting) suggests a shift toward evaluating governance outcomes and enabling cross-sectoral integration.

In terms of node dynamics, foundational terms such as "carbon tax," "environmental regulation," "Porter hypothesis," and "green technological innovation" appeared early and retain centrality. More recent terms such as "low-carbon technology innovation" and "environmental protection tax" show increasing prominence, highlighting their relevance in firm-level innovation under new policy regimes.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue V May 2025

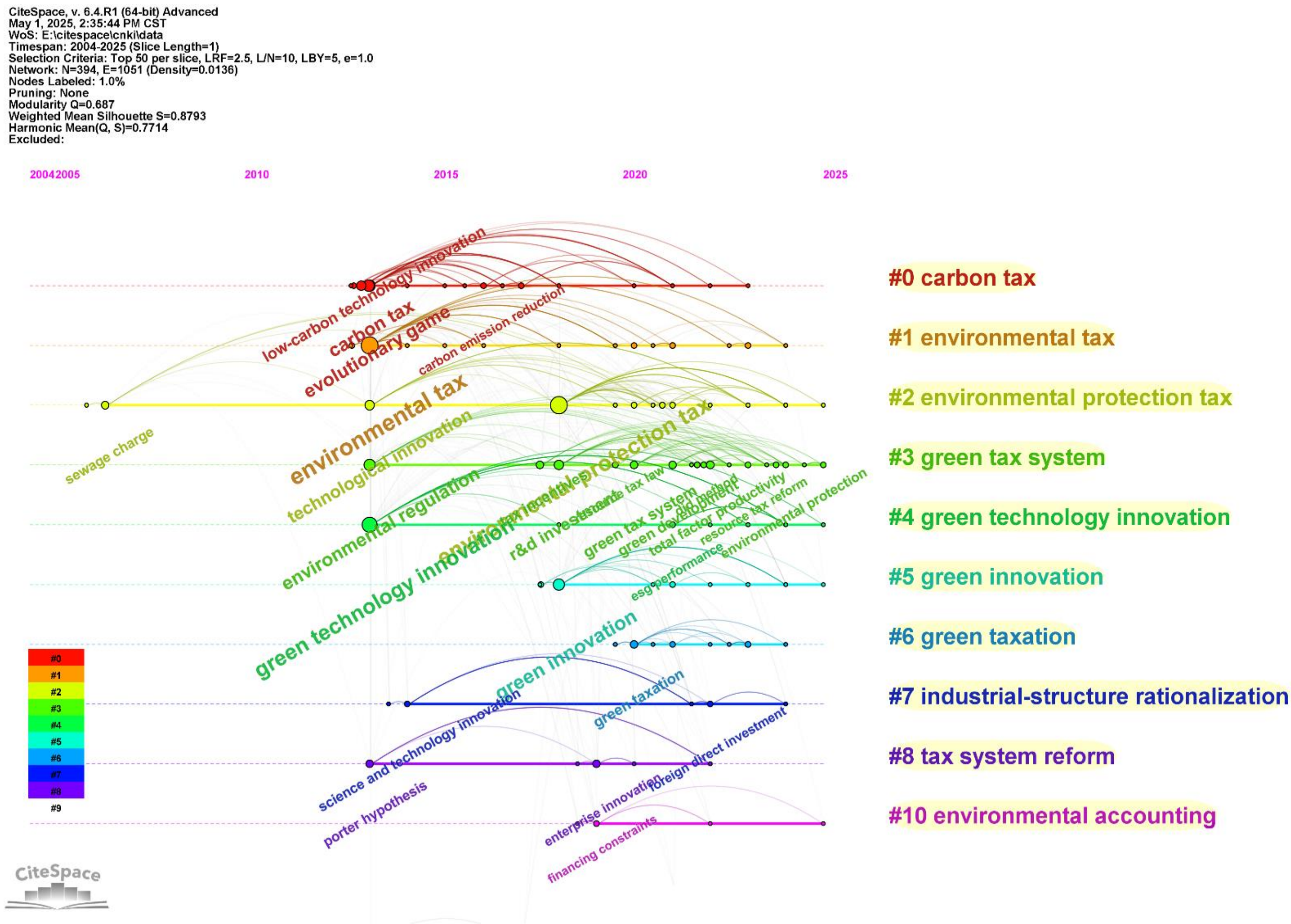

Figure 7. Time Evolution of Research Themes in Chinese Literature on Green Taxation and Technological Innovation (2000–2025)

Note: Horizontal lines represent keyword clusters; node size indicates frequency. Color/lines depict temporal evolution and topic continuity.

Based on Figure 8, Chinese literature also exhibits a three-phase evolution:

Phase I (2013–2017): Policy Exploration and Theoretical Importation Keywords such as "carbon tax," "emissions trading," and "low-carbon technology innovation" dominate. This period was shaped by China's carbon trading pilots, with theoretical frameworks often drawn from EU experiences (Lan et al., 2013; Wang, 2016; Long et al., 2016).

Phase II (2016–2021): Institutional Pilots and Empirical Deepening The enactment of the Environmental Protection Tax Law in 2018 triggered a shift toward empirical evaluation. Keywords such as "environmental tax," "green product innovation," and "enterprise innovation" point to model-based testing of tax-performance linkages (Tan, 2021; Zhen & Jiang, 2021; Yu et al., 2021).

Phase III (2022–present): Outcome Evaluation and Integrated Modeling Emerging terms include "R&D investment," "environmental performance," and "green innovation." Research now emphasizes spatial heterogeneity, firm-level response, and policy synergy amid dual-carbon implementation (Liu et al., 2024; Li & Li, 2022; Yu et al., 2023).

In conclusion, both Chinese and international literature exhibit a common three-phase developmental

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue V May 2025

trajectory—policy experimentation, mechanism construction, and performance optimization—suggesting conceptual convergence in green tax research (Liu et al., 2023; Zhang et al., 2023). Yet, divergent emphases remain: international studies prioritize comparative policy modeling and macro-level simulations (Chai et al., 2025; Zhang et al., 2025), while Chinese studies focus on reform implementation, behavioral mechanisms, and micro-level empirical strategies (Wang & Zhao, 2023; Chen et al., 2025).

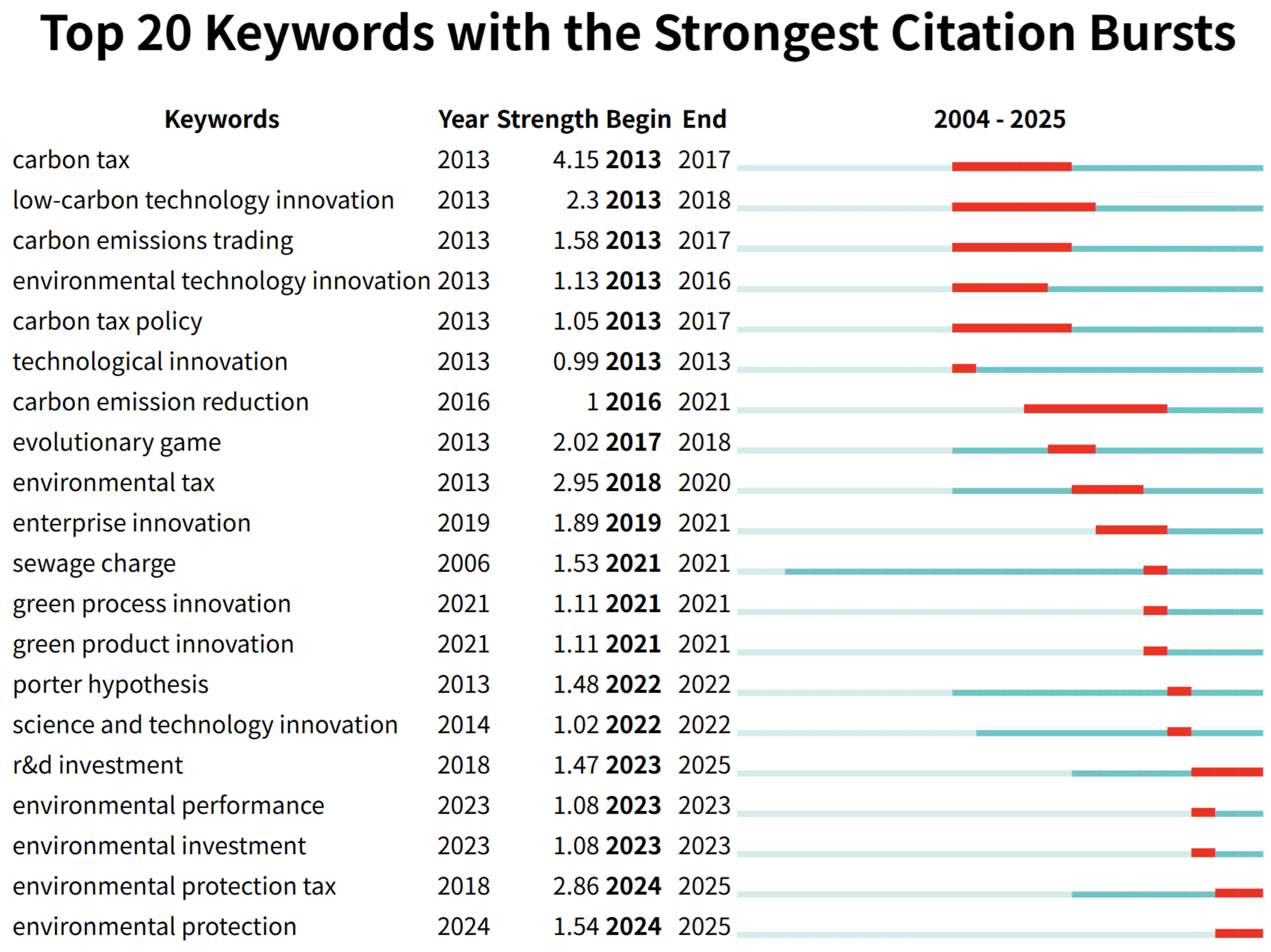

Figure 8. Burst Detection of Keywords in Chinese Literature (2000–2025)

Note: Red bars denote high-frequency emergence periods, indicating dynamic research focus shifts.

These discrepancies stem from differences in institutional maturity and policy infrastructure. While international systems are more advanced and focused on performance refinement (Chatzistamoulou & Dimakopoulou, 2025), China's system remains in dynamic optimization, marked by temporal and regional variability. This evolving asymmetry presents valuable comparative ground for advancing the global integration of green tax innovation frameworks (Liu & Zhou, 2025).

DISCUSSION, CONTRIBUTIONS, AND FUTURE RESEARCH DIRECTIONS

Research Conclusions

Focusing on the relationship between green taxation and corporate technological innovation, this study conducted a comprehensive bibliometric analysis of Chinese and international literature from 2000 to 2025 using CiteSpace. Through analyses of keyword co-occurrence, thematic clustering, institutional collaboration, and temporal evolution, a comparative knowledge map was constructed, revealing systematic differences in research themes, methodologies, and evolutionary trajectories.

(1)Three Core Pillars with Divergent Focal Points

Both Chinese and international research emphasize green taxes, innovation, and regulation, but the emphasis differs (Xie & Zhou, 2025; Zhang et al., 2025；Chai et al., 2025；Chatzistamoulou et al., 2025). International literature focuses on carbon taxes as part of integrated finance–market–technology systems aligned with climate governance and sustainable development goals (Saqib et al., 2023; Bigerna et al., 2025). Chinese studies center on firm-level responses to tools like the Environmental Protection Tax, emphasizing R&D investment, innovation output, and strategic transformation (Chen et al., 2025; Hu & Guo, 2025).

(2) Three-Phase Evolution with Varying Rhythms

The literature follows a three-stage trajectory: policy experimentation (2000–2012), mechanism construction (2013–2019), and performance optimization (2020–2025). International research initially modeled tax effectiveness in promoting low-carbon innovation; Chinese studies were more focused on institutional argumentation. In the second phase, Chinese scholars empirically tested Porter's hypothesis using econometric methods, while international studies expanded to systemic synergy modeling. In the latest phase, Chinese literature addresses spatial and digital dimensions of innovation (Chen et al., 2025; Liu & Yang, 2025), while international work embeds taxation into multi-level governance structures (Chai et al., 2025; Tchorzewska et al., 2025).

(3) Divergent Theoretical and Methodological Pathways

International research evolves from optimal taxation theory to complex adaptive systems (CAS) and multi-level transition theory (MLP), focusing on feedback and institutional embedding (Chatzistamoulou & Dimakopoulou, 2025). Chinese studies, grounded in Porter's hypothesis and institutional economics, integrate resource-based views, dynamic capabilities, and evolutionary game models to address behavioral heterogeneity (Saqib et al., 2023; Chen et al., 2024; Chai et al., 2025). Methodologically, international studies favor integrated simulations (ABM, CGE, QCA), while Chinese literature adopts econometrics, DEA-SBM, spatial models, and machine learning (Xu et al., 2025; Zhu et al., 2025; Pan & Zhang, 2025）).

(4) Fragmented Collaboration Networks

Both corpora exhibit low-density author and institutional networks, concentrated within universities in research-intensive regions (Xu & Huang, 2024). Collaboration densities remain low (0.0407 in Chinese, 0.0092 in English), with minimal cross-border integration, limiting comparative learning and policy transfer (Wei & Zhao, 2023).

(5) Policy Relevance Strengthened Through Grey Literature

This study integrates grey literature—government reports, legislative briefs, and policy assessments—to validate model assumptions and extend practical relevance. For example, early legislative notes confirm the incentive role of taxation (NPCSC, 2016; Chen, 2004). Ministry of Finance briefs during the mechanism phase support empirical findings on cost reallocation and innovation promotion (Bi & Yu, 2018). In the optimization stage, OECD (2024) and China's 14th Five-Year Plan highlight policy performance frictions aligned with structural limitations found in recent studies (Desmarchelier et al., 2021).

To integrate these findings, a conceptual framework is proposed (Figure 9), showing the interaction of green taxation mechanisms across three structural levels. Macro-level incentives generate institutional signals; meso-level adjustments affect industry structures; and micro-level responses involve innovation behavior and technological adaptation. This nested model supports future simulations and layered policy evaluations.

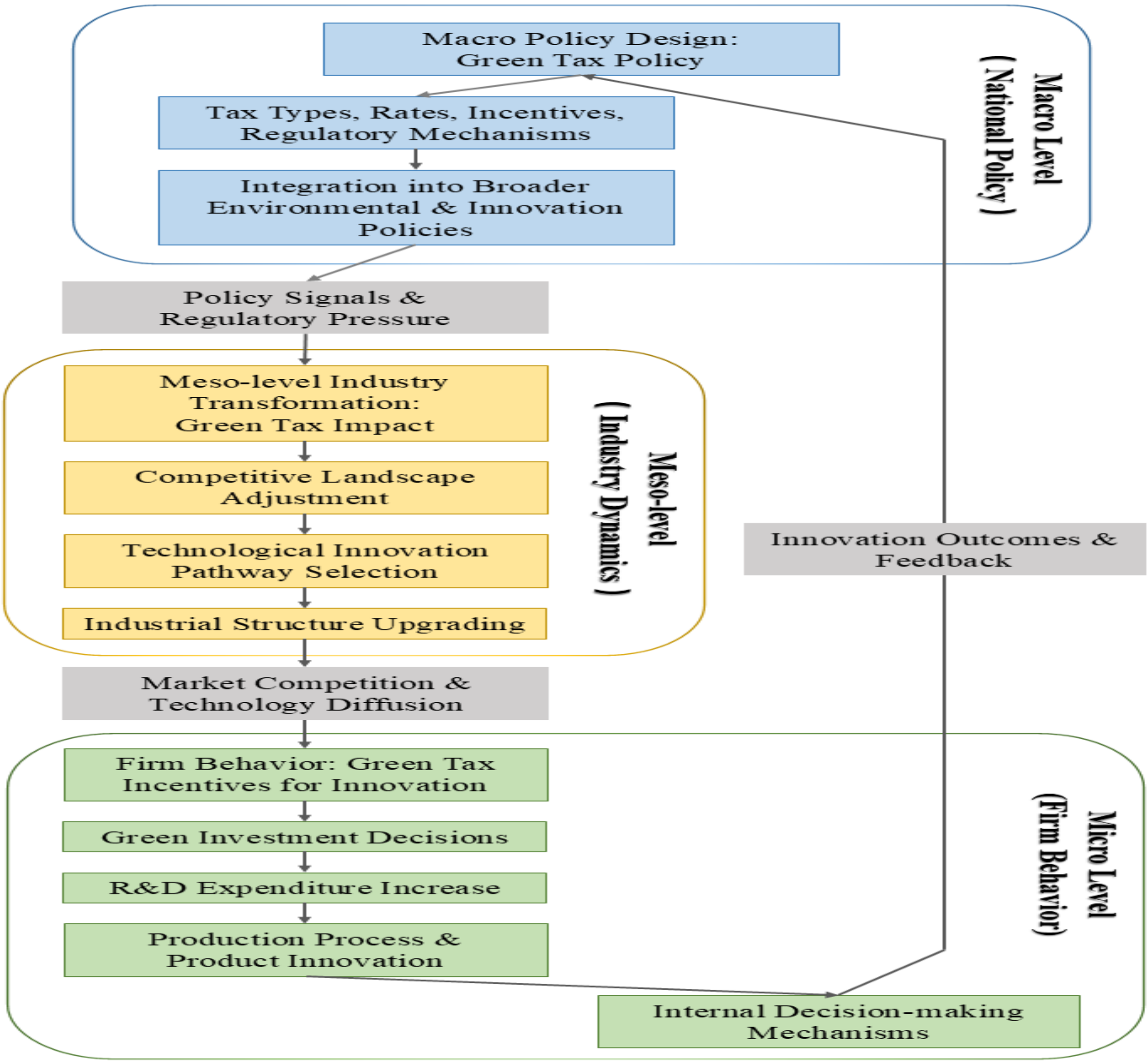

Figure 9. Nested Transmission Framework for Multi-Level Green Tax Incentives

Note: Illustrates cross-scale transmission of green tax incentives across macro (policy), meso (industry), and micro (firm) levels.

Research Contributions

Based on bibliometric mapping and thematic content analysis, this study makes four key contributions to the field of green taxation and enterprise innovation:

(1) Cross-Linguistic Knowledge Map and Structural Differentiation

This study is the first to develop a bilingual knowledge map comparing Chinese and international core literature on green taxation and innovation using CiteSpace. It addresses structural divergence and contextual fragmentation across academic systems. By integrating clustering, co-occurrence, and burst detection, the study traces the field's evolution from early tool theory (Wang & Wu, 2023) to mechanism building (Bi & Yu, 2018) and performance evaluation (Zhu, 2023; Xu, 2025). Bursts linked to policy milestones (e.g., Kyoto, Paris, CBAM) affirm the policy–knowledge feedback loop in green transition scholarship.

(2) Mechanism Chain Linking Green Tax to Innovation Outcomes

The study identifies a three-stage mediating mechanism: policy incentives → firm response → performance outcomes. It incorporates moderators such as firm heterogeneity (ownership, sector) (Liu & Yang, 2025), policy intensity (tax level, incentives) (Wu et al., 2024), and geographic conditions (Wang et al., 2023). This mechanism supports empirically operationalized modeling. The methodological trajectory reflects a field-wide shift from qualitative to empirical to systems-based research.

(3) Integration of Grey Literature to Reinforce Institutional Validity

Beyond academic sources, this study draws on grey literature from China's Ministry of Finance, NPCSC, OECD, and others to validate academic models and enhance institutional realism. Feedback loops between policy documents and thematic clusters reinforce alignment between theory and practice—for example, endogenous constraint theory (Xu et al., 2025) and incentive asymmetry (OECD, 2024).

(4) Proposal of a Multi-Level Governance Framework

A conceptual framework is proposed to model the cascading effects of green tax policy from macro signals to firm-level outcomes. It provides a foundation for developing multi-scale simulations (e.g., CGE–ABM, DSGE–SDM). The framework contributes to emerging green governance theory (Hamaguchi & Yoshihiro, 2023; Liu & Yang, 2025) and supports practical applications in integrated policy planning and firm strategy development (Hu & Guo, 2025; Tchorzewska, 2025).

Research Gaps

Despite recent advances in theory construction and empirical methodologies, this study identifies four persistent gaps in the literature:

(1) Lack of Cross-Scale Mechanism Models Connecting Macro, Meso, and Micro Levels

Existing studies often address individual levels—firm behavior, policy formulation, or industry dynamics—without integrating their interactions. While some use mediation models or heterogeneity analysis (Wang & Yu, 2023; Huang et al., 2025), few capture the full incentive–response–performance chain (Liu et al., 2024; Zhou et al., 2023). Grey literature (e.g., 14th Five-Year Plan, Ministry of Finance reports) signals cross-level fragmentation, yet modeling frameworks that simulate integrated dynamics remain scarce (Yan et al., 2025).

(2) Weak Identification of Fiscal Synergies and Institutional Nesting

Although green taxes are commonly embedded in broader fiscal ecosystems—including subsidies, carbon markets, and green finance (OECD, 2024; Xu et al., 2025)—most studies isolate variables. Few assess marginal effects, synergy thresholds, or substitutability among instruments (Carattini et al., 2021). Analytical frameworks rarely incorporate frictions or institutional misalignments, despite being widely noted in grey materials such as the State Council's carbon trading guidelines (Chen et al., 2024).

(3) Limited Dimensions in Measuring Innovation Heterogeneity

Innovation output is often proxied by aggregated green patent counts, overlooking patent types (invention vs. utility), lifecycle stages (exploratory vs. exploitative), and ecological functions (emissions vs. resource efficiency). This constrains analysis of strategic intent and resource allocation (Liu & Yang, 2025; Chen et al., 2024). Reports from OECD and UNEP highlight time-lagged responses and performance asymmetry, yet few models integrate these as structural parameters (Liu et al., 2025).

(4) Insufficient Cross-Contextual Integration and Policy Transferability

Disparities in institutional logic, terminology, and modeling practices limit interoperability between Chinese and international literature (Wang et al., 2022; Chen et al., 2025). There is no multilingual, interoperable knowledge map enabling semantic and structural alignment. Although grey literature alludes to institutional divergence, few comparative models bridge localized Chinese contexts with international policy norms (Zhang & Yin, 2023; Zhou et al., 2023).

Future Research Directions

In response to the identified gaps and paradigm shifts, future research on green taxation and corporate innovation should advance in the following five directions:

(1) Developing Cross-Scale Nested Models for Dynamic Simulation

Scholars should design nested SEMs, hierarchical panel models, and system dynamics (SD) frameworks that simulate multi-tiered interactions—from macro-level institutional incentives, to meso-level industrial dynamics, and micro-level enterprise responses. Integration of grey data (e.g., fiscal policy timelines, regulatory adaptation periods) will enhance contextual validity (Yan et al., 2025; Ministry of Finance, 2023).

(2) Modeling Fiscal Policy Portfolios and Interaction Effects

Future models should assess the co-evolution and sequencing of multiple policy tools, including carbon taxes, green subsidies, and credit mechanisms. Interaction effects (e.g., complementarity, diminishing returns) must be quantified, with grey sources such as policy implementation guidelines and sectoral allocation reports informing parameter calibration (Yu et al., 2022; Carattini et al., 2021).

(3) Enhancing Innovation Metrics and Multi-Dimensional Performance Indicators

Innovation should be measured using diversified indicators, including patent quality, technological maturity, and environmental impact classification. Complementary metrics (e.g., carbon productivity, supply chain decarbonization, green total factor productivity) should be embedded to capture firm-level innovation heterogeneity (Chen et al., 2024; Liu et al., 2023). Variables such as strategic flexibility, path dependence, and time lags should inform predictive model design (Aghion et al., 2021).

(4) Constructing Cross-Contextual Knowledge Maps to Enable Policy Migration

Future studies should adopt semantic network analysis, policy co-occurrence mapping, and text coding of institutional logics to develop contrastive knowledge maps between Chinese and international systems. These maps can support theory translation and contextual adaptation by tracing regulatory logic and implementation variance (Mahmood et al., 2022; OECD, 2024).

(5) Promoting Interdisciplinary Integration in Institutional Modeling

Theoretical and empirical research should draw from finance, institutional economics, and organizational behavior to understand how firms interpret and respond to institutional signals. Mixed-method designs—such as agent-based modeling (ABM), fuzzy-set QCA, and embedded case studies—can improve causal inference in complex institutional settings (Rengs et al., 2020). Future research should also reflect Chinese institutional distinctiveness, including regional experimentation, administrative layering, and local–central bargaining (Lin & Gao, 2024).

Amid the dual-carbon transition and evolving global governance landscape, the role of green taxation in driving enterprise innovation remains critical. Future research should emphasize multi-scale modeling, compound instrument assessment, and international-local integration to strengthen explanatory depth and policy utility for both regulators and enterprise stakeholders.

Ethical Approval and Informed Consent Statement

This study is a bibliometric review based on publicly available literature and does not involve any human subjects, animal research, or identifiable personal data. Therefore, ethical approval and informed consent were not required.

Conflicts of Interest

The authors declare no conflict of interest.

Data Availability Statement

The data used in this study were obtained from publicly accessible databases. Specifically, English-language bibliographic data were retrieved from the Web of Science Core Collection, and Chinese-language data were sourced from the China National Knowledge Infrastructure (CNKI). All data used for the bibliometric analysis are available upon reasonable request from the corresponding author.

Author Contributions

Author Contributions: Conceptualization, data collection, formal analysis, methodology, visualization, and original draft preparation were all completed by Zelin Zhang. Supervision and general academic guidance were provided by Assoc Prof. Mui Yee, Cheok. All authors have read and agreed to the published version of the manuscript.

Copyright and Licensing

REFERENCES

1. Aalbers, R., Shestalova, V., & Kocsis, V. (2013). Innovation policy for directing technical change in the power sector. Energy policy, 63, 1240-1250.https://doi.org/10.1016/j.enpol.2013.09.013
2. Ba, H., Zhang, L., He, X., & Li, S. (2025). Knowledge mapping and global trends in simulation in medical education: Bibliometric and visual analysis. JMIR Medical Education, 11(1), e71844.https://mededu.jmir.org/2025/1/e71844/

3. Bai, Y. (2024). The impact of the reform from environmental fees to taxes on enterprise innovation quality: Empirical evidence based on panel data of listed companies. Economic and Management Review, 5, 96–108. https://doi.org/10.13962/j.cnki.37-1486/f.2024.05.008. [In Chinese]
4. Bashir, M. F., Sharif, A., Staniewski, M. W., Ma, B., & Zhao, W. (2024). Environmental taxes, energy transition and sustainable environmental technologies: A comparative OECD region climate change analysis. Journal of Environmental Management, 370, 122304.https://doi.org/10.1016/j.jenvman.2024.122304
5. Bataineh, M. J., Sánchez-Sellero, P., & Ayad, F. (2024). Green is the new black: How research and development and green innovation provide businesses a competitive edge. Business Strategy and the Environment, 33(2), 1004-1023. https://doi.org/10.1002/bse.3533
6. Bi, Q., & Yu, L. C. (2019). Environmental taxation and enterprise technological innovation: Promotion or suppression? Science Research Management, (12), 116–125. https://doi.org/10.19571/j.cnki.1000-2995.2019.12.012
7. Bian, C., Chu, Z. P., & Wang, H. (2023). Policy simulation of government support for green and low-carbon technology R&D under the “dual carbon” goals. Soft Science, 8, 94–102. https://doi.org/10.13956/j.ss.1001-8409.2023.08.13. [In Chinese]
8. Cai, R., Wang, X., Cheng Vong, C., Zhao, S., & Zhang, T. (2024). Low-carbon urban development hot topics and frontier evolution: a bibliometric study from a global perspective. Frontiers in Built Environment, 10, 1464529.https://doi.org/10.3389/fbuil.2024.1464529
9. Chai, S., Huo, W., Li, Q., Ji, Q., & Shi, X. (2025). Effects of carbon tax on energy transition, emissions and economy amid technological progress. Applied Energy, 377, 124578.https://doi.org/10.1016/j.apenergy.2024.124578
10. Chatzistamoulou, N., & Dimakopoulou, A. G. (2025). Do climate change policy instruments loom like the sword of Damocles over green technology independence to achieve green growth and sustainability in Europe?. Technological Forecasting and Social Change, 215, 124100.https://doi.org/10.1016/j.techfore.2025.124100
11. Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. Journal of the American Society for Information Science and Technology, 57(3), 359–377. https://doi.org/10.1002/asi.20317
12. Chen, G. Z., Lin, F. Y., & Fu, K. B. (2024). The impact of environmental protection tax on green technology innovation under the dual carbon goals: Evidence from A-share listed companies. Shanghai Economic Review, 7, 95–104. https://doi.org/10.19626/j.cnki.cn31-1163/f.2024.07.006. [In Chinese]
13. Chen, H., Pan, J. J., & Pei, Y. (2025). The impact of environmental protection tax on enterprise growth. Taxation and Economy Research, 1, 46–58. https://doi.org/10.16340/j.cnki.ssjjyj.2025.01.003. [In Chinese]
14. Chen, N. X., Zhang, J. T., & Wang, L. T. (2024). Tax administration and China’s industrial low-carbon transition: Empirical evidence from the perspective of green taxation. Southern Economy, 4, 1–19. https://doi.org/10.19592/j.cnki.scje.412090. [In Chinese]
15. Chen, W., Wu, X., & Yang, J. (2022). A bibliometric and visualized analysis of global research on climate change adaptation (1991–2021). Environmental Science and Ecotechnology, 11, 100138. https://doi.org/10.1016/j.ese.2022.100138
16. Chen, Y. H., Wang, C., Nie, P. Y., & Chen, Z. R. (2020). A clean innovation comparison between carbon tax and cap-and-trade system. Energy Strategy Reviews, 29, 100483.https://doi.org/10.1016/j.esr.2020.100483
17. Chen, Z. H. (2004). On the economic incentives of ecological taxation: With a discussion on government behavior in western ecological compensation. Taxation and Economy (Journal of Changchun Taxation College), 6, 55–57. https://doi:CNKI:SUN:SWYJ.0.2004-06-019. [In Chinese]
18. Cheng, C. G., Zhou, H. W., & Yan, X. (2024). Cooperative R&D strategy for water-saving technologies

in high water-consuming enterprises: A game-theoretic study under water resource tax regulation. R&D Management, 2, 74–86. https://doi.org/10.13581/j.cnki.rdm.20221342. [In Chinese]

19. Cheng, N., & Chen, C. (2021). Marine carbon sinks, carbon tax, and green technology: A combined strategy to achieve the “dual carbon” goals. Journal of Shandong University (Philosophy and Social Sciences), 6, 150–161. https://doi.org/10.19836/j.cnki.37-1100/c.2021.06.015. [In Chinese]
20. Chu, T., Zhong, Y. G., Sun, H., & Jia, W. Q. (2024). Carbon neutrality pathway for the home appliance industry considering consumer carbon responsibility. Systems Engineering—Theory & Practice, 3, 1018–1037. [In Chinese]
21. Clarivate Analytics. (n.d.). Web of Science Core Collection: Content overview. Retrieved May 3, 2025, from https://clarivate.com/webofsciencegroup/solutions/web-of-science-core-collection/
22. Congressional Research Service. (2022, August 17). Inflation Reduction Act of 2022: Summary of energy and climate provisions (CRS Report No. IN11978). U.S. Library of Congress.https://crsreports.congress.gov/product/pdf/IN/IN11978
23. Cui, L. H., & Xu, S. Y. (2025). Statistical analysis and development strategies of core author groups in key journals: A case study of Journal of Metrology. Science & Technology Communication, (07), 64–67. https://doi.org/10.16607/j.cnki.1674-6708.2025.07.016
24. Deng, P., Liu, C., Chen, M., & Si, L. (2023). Knowledge domain and emerging trends in multimorbidity and frailty research from 2003 to 2023: A scientometric study using CiteSpace and VOSviewer. Health Economics Review, 13, Article 60. https://doi.org/10.1186/s13561-023-00460-9
25. Desmarchelier, B., Djellal, F., & Gallouj, F. (2013). Environmental policies and eco-innovations by service firms: An agent-based model. Technological Forecasting and Social Change, 80(7), 1395-1408.
26. Ding, X., Lu, D., Wei, R., & Zhu, F. (2025). Knowledge mapping of online healthcare: An interdisciplinary visual analysis using VOSviewer and CiteSpace. Digital Health, 11, 20552076251320761. https://doi.org/10.1177/20552076251320761
27. Duan, Y., & Rahbarimanesh, A. (2024). The Impact of Environmental Protection Tax on Green Innovation of Heavily Polluting Enterprises in China: A Mediating Role Based on ESG Performance. Sustainability, 16(17), 7509. https://doi.org/10.3390/su16177509
28. European Commission. (2021). Green taxation and other economic instruments: Internalising environmental costs to make the polluter pay [Study Report]. Directorate-General for Environment. https://environment.ec.europa.eu/system/files/2021-11/Green%20taxation%20and%20other%20economic%20instruments%20%E2%80%93%20Internalising%20environmental%20costs%20to%20make%20the%20polluter%20pay_Study_10.11.2021.pdf
29. European Union. (2023). Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism. Official Journal of the European Union, L 130, 52–104. Retrieved from https://eur-lex.europa.eu/eli/reg/2023/956/oj
30. Fang, X. C., & Yang, Y. (2025). Environmental protection tax, green technological innovation, and urban green low-carbon development: Evidence from the Yangtze River Delta. Ecological Economy, 2, 83–91. [In Chinese]
31. Farooq, U. (2023). Exploring the external forces driving green environmental innovation: empirical evidence from Asian market. Economic Change and Restructuring, 56(2), 981-1006.https://doi.org/10.1007/s10644-022-09463-8
32. Farooq, U., Wen, J., Tabash, M. I., & Fadoul, M. (2024). Environmental regulations and capital investment: Does green innovation allow to grow?. International Review of Economics & Finance, 89, 878-893.https://doi.org/10.1016/j.iref.2023.08.010
33. Greater, M., & Pade, L. L. (2009). Optimal carbon dioxide abatement and technological change: should emission taxes start high in order to spur R&D?. Climatic Change, 96(3), 335-355.https://doi.org/10.1007/s10584-009-9643-x
34. Grimaud, A., & Rouge, L. (2008). Environment, directed technical change and economic

policy. Environmental and Resource Economics, 41, 439-463.https://doi.org/10.1007/s10640-008-9201-4

35. Gu, Q., Hang, L., & Jiang, Y. (2024). Compound carbon policy for promoting low-carbon technology innovation in enterprises considering government supervision. Environment, Development and Sustainability, 1-29.https://doi.org/10.1007/s10668-024-05336-4
36. Guan, H., Zhang, Y., & Zhao, A. (2023). Environmental taxes, enterprise innovation, and environmental total factor productivity—effect test based on Porter's hypothesis. Environmental Science and Pollution Research, 30(44), 99885-99899.https://doi.org/10.1007/s11356-023-29407-7
37. Guo, B., Feng, W., & Zhang, H. (2025). Can Market-Based Environmental Regulation Inhibit the Industrial Water Pollution?. Polish Journal of Environmental Studies, 34(1).DOI: 10.15244/pjoes/186487
38. Hamaguchi, Y. (2023). Environmental tax evasion as a determinant of the Porter and pollution haven hypotheses in a corrupt political system. Economic Analysis and Policy, 79, 610-633.https://doi.org/10.1016/j.eap.2023.06.032
39. Han, F., & Yan, S. Q. (2023). Can environmental protection tax promote regional green total factor productivity growth? An empirical study based on Bayesian spatiotemporal statistics. Economic Issues, 7, 103–112. https://doi.org/10.16011/j.cnki.jjwt.2023.07.014. [In Chinese]
40. Hart, R. (2008). The timing of taxes on CO2 emissions when technological change is endogenous. Journal of Environmental Economics and Management, 55(2), 194-212.https://doi.org/10.1016/j.jeem.2007.06.004
41. He, Y., Zhu, X., & Zheng, H. (2022). The influence of environmental protection tax law on total factor productivity: Evidence from listed firms in China. Energy Economics, 113, 106248.https://doi.org/10.1016/j.eneco.2022.106248. [In Chinese]
42. Heggedal, T. R., & Jacobsen, K. (2011). Timing of innovation policies when carbon emissions are restricted: an applied general equilibrium analysis. Resource and Energy Economics, 33(4), 913-937. https://doi.org/10.1016/j.reseneeco.2010.12.002
43. Hu, H. S., & Guo, N. (2025). Research on the environmental protection tax system and optimization of tax collection from the perspective of green innovation. Taxation Research, 2, 131–138. https://doi.org/10.19376/j.cnki.cn11-1011/f.2025.02.017. [In Chinese]
44. Hu, S., Wang, A., & Du, K. (2023). Environmental tax reform and greenwashing: evidence from Chinese listed companies. Energy Economics, 124, 106873.https://doi.org/10.1016/j.eneco.2023.106873
45. Huang, L., Li, X. Y., Xiong, R. Y., & Xiao, J. H. (2025). The boundary of environmental protection tax and enterprise green innovation: A dual perspective of breadth and depth. Theory and Practice of Finance and Economics, 1, 60–67. https://doi.org/10.16339/j.cnki.hdxbcjb.2025.01.008. [In Chinese]
46. Huang, Y., Liu, C., Wang, L., & Qi, Y. (2025). CEThe Impact of Environmental Protection Tax on Corporate ESG Performance and Corporate Green Behavior. Research in International Business and Finance, 102772.https://doi.org/10.1016/j.ribaf.2025.102772
47. Huo, H., Yang, R. B., & Zhan, S. (2023). Government-enterprise low-carbon emission reduction strategies under vehicle carbon tax policy. Journal of Chongqing University of Technology (Natural Science), 1, 232–243. https://doi:CNKI:SUN:CGGL.0.2023-01-027. [In Chinese]
48. International Monetary Fund. (2023). A framework for climate change mitigation in India (IMF Working Paper No. WP/23/218). https://www.imf.org/-/media/Files/Publications/WP/2023/English/wpiea2023218-print-pdf.ashx
49. Karmaker, S. C., Hosan, S., Chapman, A. J., & Saha, B. B. (2021). The role of environmental taxes on technological innovation. Energy, 232, 121052.https://doi.org/10.1016/j.energy.2021.121052
50. Lan, H., Sun, Y. Z., Wu, C., Ge, J., & Pan, X. L. (2013). Policy tools and technological innovation measures for the EU's low-carbon economic transition strategy. Ecological Economy, 6, 62–66. https://doi:CNKI:SUN:STJJ.0.2013-06-013. [In Chinese]

51. Lan, X., Zhang, Z., Ma, N., An, K., & Xie, X. (2024). How does environmental protection tax affect corporate technological innovation? -Perspective of corporate governance. Applied Economics Letters, 1-9.https://doi.org/10.1080/13504851.2024.2442487
52. Lennox, J. A., & Witajewski-Baltvilks, J. (2017). Directed technical change with capital-embodied technologies: implications for climate policy. Energy Economics, 67, 400-409.https://doi.org/10.1016/j.eneco.2017.08.005
53. Li, L., Wu, S., Cao, Y., He, Y., Wu, X., Xi, H., et al. (2024). Visual analysis of hot topics and trends in nutrition for decompensated cirrhosis between 1994 and 2024. Journal of the American Nutrition and Health Sciences. https://doi.org/10.1080/27697061.2024.2401608
54. Li, R., Yang, Y., Gao, Y., Lv, J., Dai, C., Zhai, Y., & Mao, C. (2025). Knowledge map of programmed cell death in esophageal cancer: A bibliometric analysis. Discover Oncology.https://doi.org/10.1007/s12672-025-02376-8
55. Li, X., & Wang, Y. L. (2024). The impact of environmental tax on enterprise green technology innovation: Data analysis based on specialized and sophisticated enterprises. Journal of Technology Economics and Management Research, 3, 26–31. https:// doi:CNKI:SUN:JXJG.0.2024-03-005. [In Chinese]
56. Li, X., Xu, S., & Xiong, Y. (2024). Does implementation of a environmental protection tax reduce energy consumption: evidence from China. Annals of Operations Research, 1-17.https://doi.org/10.1007/s10479-023-05805-5
57. Li, Y. H., & Li, P. Y. (2022). The impact of environmental protection tax on the level of green technology innovation in enterprises: Evidence from listed industrial firms in Shanghai and Shenzhen. Taxation Research, 11, 52–58. https://doi.org/10.19376/j.cnki.cn11-1011/f.2022.11.023. [In Chinese]
58. Lin, F., & Gao, P. (2024). Research on the optimization of the green tax system to serve Chinese-style modernization. Taxation Research, 1, 17–21. https://doi.org/10.19376/j.cnki.cn11-1011/f.2024.01.003. [In Chinese]
59. Liu, G., Sun, W., Kong, Z., Dong, X., & Jiang, Q. (2023). Did the pollution charge system promote or inhibit innovation? Evidence from Chinese micro-enterprises. Technological Forecasting and Social Change, 187, 122207.https://doi.org/10.1016/j.techfore.2022.122207
60. Liu, J., Long, F., Chen, L., Li, L., Zheng, L., & Mi, Z. (2025). Exploratory or exploitative green innovation? The role of different green fiscal policies in motivating innovation. Technovation, 143, 103207. https://doi.org/10.1016/j.technovation.2025.103207
61. Liu, L. J., Wu, S. S., & Li, T. Y. (2024). The impact of environmental protection tax on green innovation in real-sector enterprises. Friends of Accounting, 5, 108–115. [In Chinese]
62. Liu, L. Y. (2024). The impact of patent cooperation network embedding on sustainable innovation in firms: Evidence from Chinese listed pharmaceutical manufacturers. Science & Technology Entrepreneurship Monthly, (06), 33–39. CNKI:SUN:KJCK.0.2024-06-005. [In Chinese]
63. Liu, L., & Zhou, Y. (2025). The impact of environmental taxation on pollution emissions and economic growth: An empirical study based on panel data and threshold models. Taxation Research, 2, 95–101. https://doi.org/10.19376/j.cnki.cn11-1011/f.2025.02.021. [In Chinese]
64. Liu, Q., & Zhu, X. (2024). How carbon tax policy affects the carbon emissions of manufacturers with green technology spillovers?. Environmental Modeling & Assessment, 29(5), 971-985.https://doi.org/10.1007/s10666-024-09965-x
65. Liu, R. H., Yang, Y., Ding, M. L., & Wang, S. H. (2022). Research on the construction and innovation path of China's green and low-carbon technology system under the “dual carbon” goals. Guangxi Social Sciences, 4, 8–15. [In Chinese]
66. Liu, S., & Yang, D. H. (2025). Reform direction and construction path of the green tax system. Qilu Journal, 2, 108–122. https://doi:CNKI:SUN:QLXK.0.2025-02-011. [In Chinese]
67. Liu, S., Xu, P., & Chen, X. (2023). Green fiscal policy and enterprise green innovation: evidence from quasi-natural experiment of China. Environmental Science and Pollution Research, 30(41), 94576-94593.

https://doi.org/10.1007/s11356-023-28847-5

68. Liu, X., Duan, S., & Yao, J. T. (2023). Environmental protection tax and corporate green performance: Multiple dividends or trade-offs? Economic Issues, 10, 70–79. https://doi.org/10.16011/j.cnki.jjwt.2023.10.006. [In Chinese]
69. Long, F., Qi, H. B., Liu, X. P., & Zhang, M. (2016). Response mechanisms and system simulation of enterprise carbon emission reduction technological innovation under a carbon tax scenario. Technology Economics, 8, 92–98. https://doi:CNKI:SUN:JSJI.0.2016-08-013. [In Chinese]
70. Mahmood, N., Zhao, Y., Lou, Q., & Geng, J. (2022). Role of environmental regulations and eco-innovation in energy structure transition for green growth: Evidence from OECD. Technological Forecasting and Social Change, 183, 121890.https://doi.org/10.1016/j.techfore.2022.121890
71. Meng, F. S., & Han, B. (2017). The influence mechanism of environmental regulation on low-carbon technological innovation behavior of enterprises. Forecasting, (01), 74–80. CNKI:SUN:YUCE.0.2017-01-012. [In Chinese]
72. Mi, F. F., & Zhang, Z. L. (2020). Does environmental taxation promote firm innovation? Evidence from Chinese patent data. Journal of Harbin University of Commerce (Social Sciences Edition), (06), 80–90. CNKI:SUN:HLJC.0.2020-06-007. [In Chinese]
73. Murad, S. W., Rahman, A., & Mohsin, A. K. M. (2025). From policy to progress: Environmental taxation to mitigate air pollution in OECD countries. Journal of Environmental Management, 374, 124143. https://doi.org/10.1016/j.jenvman.2025.124143
74. Nobanee, H., & Ullah, S. (2023). Mapping green tax: A bibliometric analysis and visualization of relevant research. Sustainable Futures, 5, 100108.https://doi.org/10.1016/j.sftr.2023.100108
75. Okombi, I.F., Ndoum Babouama, V.BD. (2024). Environmental taxation and inclusive green growth in developing countries: does the quality of institutions matter?. Environ Sci Pollute Res 31, 30633–30662. https://doi.org/10.1007/s11356-024-33245-6
76. Organisation for Economic Co-operation and Development. (2024). Pricing greenhouse gas emissions: Key findings for Korea. OECD Publishing.https://www.oecd.org/tax/tax-policy/carbon-pricing-korea.pdf
77. Organisation for Economic Co-operation and Development. (2025). OECD environmental performance reviews: Japan 2025. OECD Publishing. Retrieved from https://www.oecd.org/en/publications/2025/03/oecd-environmental-performance-reviews-japan-2025_947dc3da.html
78. Qamruzzaman, M., Karim, S., & Kor, S. (2024). Nexus between innovation–openness–natural resources–environmental quality in N-11 countries: what is the role of environmental tax?. Sustainability, 16(10), 3889.https://doi.org/10.3390/su16103889
79. Rengs, B., Scholz-Wäckerle, M., & van den Bergh, J. (2020). Evolutionary macroeconomic assessment of employment and innovation impacts of climate policy packages. Journal of Economic Behavior & Organization, 169, 332-368.https://doi.org/10.1016/j.jebo.2019.11.025
80. Samad, G., & Manzoor, R. (2015). Green growth: Important determinants. The Singapore Economic Review, 60(02), 1550014.https://doi.org/10.1142/S0217590815500149
81. Sandén, B. A., & Azar, C. (2005). Near-term technology policies for long-term climate targets—economy wide versus technology specific approaches. Energy policy, 33(12), 1557-1576.https://doi.org/10.1016/j.enpol.2004.01.012
82. Shiell, L., & Lyssenko, N. (2014). Climate policy and induced R&D: How great is the effect?. Energy economics, 46, 279-294. https://doi.org/10.1016/j.eneco.2014.09.017
83. Shittu, E., & Baker, E. (2010). Optimal energy R&D portfolio investments in response to a carbon tax. IEEE Transactions on Engineering management, 57(4), 547-559.doi: 10.1109/TEM.2009.2023107.
84. Song, Y., Zhang, Y., & Zhang, Y. (2022). Economic and environmental influences of resource tax: Firm-level evidence from China. Resources Policy, 77,

102751.https://doi.org/10.1016/j.resourpol.2022.102751
85. Standing Committee of the National People's Congress. (2016). Environmental Protection Tax Law of the People's Republic of China. Presidential Order No. 61 of the PRC. http://www.npc.gov.cn/zgrdw/npc/xinwen/2016-12/26/content_2004993.htm [In Chinese]
86. State Council of China. (2012). Full text of the 18th CPC National Congress Report. General Office of the Central Committee of the CPC. http://www.gov.cn/18da/2012-11/17/content_2276804.htm [In Chinese]
87. Su, L. P., Wang, Y. J., & Wang, R. Y. (2024). The impact of ESG on firm value: A literature review. Finance and Accounting Monthly, 24, 9–15, 120. https://doi.org/10.16144/j.cnki.issn1002-8072.2024.24.001. [In Chinese]
88. Sun, D., Zhang, M., & Jung, D. (2023). Policy evaluation of economic–environmental tradeoffs in regulating industrial water use: An agent-based model. Journal of Environmental Management, 346, 118988.https://doi.org/10.1016/j.jenvman.2023.118988
89. Sun, M. B., & Zheng, S. B. (2023). Diffusion mechanism of green technology innovation under dynamic influence of government subsidies and carbon taxes. Ecological Economy, 5, 78–86. https:// doi:CNKI:SUN:STJJ.0.2023-05-009. [In Chinese]
90. Sun, Z. L., Bian, C., Chu, Z. P., & Wang, H. (2021). Evolutionary simulation of carbon emission regulation and enterprise low-carbon technological innovation from the perspective of government regulation. Industrial Technology and Economics, 12, 103–112. https://doi:CNKI:SUN:GHZJ.0.2021-12-009. [In Chinese]
91. Tan, Y. Y. (2021). Online media attention, environmental tax collection, and green technology innovation in manufacturing enterprises. Finance and Accounting Monthly, 5, 80–83, 88. https://doi.org/10.16144/j.cnki.issn1002-8072.2021.05.015. [In Chinese]
92. Tchorzewska, K. B., del Rio, P., Garcia-Quevedo, J., & Martinez-Ros, E. (2025). Carrot first, stick second? Environmental policy-mix sequencing and green technologies. Technological Forecasting and Social Change, 210, 123835.https://doi.org/10.1016/j.techfore.2024.123835
93. Tchórzewska, K. B., Garcia-Quevedo, J., & Martinez-Ros, E. (2022). The heterogeneous effects of environmental taxation on green technologies. Research Policy, 51(7), 104541.https://doi.org/10.1016/j.respol.2022.104541
94. The Central Committee of the Communist Party of China & The State Council. (2024). Opinions of the CPC Central Committee and the State Council on accelerating the comprehensive green transformation of economic and social development. https://www.gov.cn/zhengce/202408/content_6967665.htm [In Chinese]
95. Tingbani, I., Salia, S., Hussain, J. G., & Alhassan, Y. (2021). Environmental tax, SME financing constraint, and innovation: evidence from OECD countries. IEEE Transactions on Engineering Management, 70(3), 1006-1025.10.1109/TEM.2021.3110812
96. United Nations Environment Programme. (2021). Making peace with nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies. United Nations.https://www.unep.org/resources/making-peace-nature
97. United Nations Framework Convention on Climate Change (UNFCCC). (2015). The Paris Agreement. Retrieved May 3, 2025, from https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
98. Wang, J. (2016). Carbon emissions trading system and clean technology bias effects. Economic Review, 2, 29–47. https://doi.org/10.19361/j.er.2016.02.003. [In Chinese]
99. Wang, J., Liao, X., & Yu, Y. (2022). The examination of resource tax reform facilitating firms' green innovation in resource-related industry in China. Resources Policy, 79, 102980.https://doi.org/10.1016/j.resourpol.2022.102980
100. Wang, K. W., & Wu, Y. X. (2023). The effect of green taxation on total factor productivity of rare earth

enterprises: An empirical analysis based on the resource tax reform. Theory and Practice of Price, 3, 116–119, 205. https://doi.org/10.19851/j.cnki.CN11-1010/F.2023.03.064. [In Chinese]

101. Wang, L., Zheng, X., Chen, T. Q., & Lin, W. J. (2025). Mechanisms and pathways of low-carbon transition in chemical enterprises driven by the "dual carbon" goals. Finance and Accounting Monthly, 7, 109–114. https://doi.org/10.19641/j.cnki.42-1290/f.2025.07.017. [In Chinese]
102. Wang, Q., Shimada, K., & Yuan, J. (2025). Water resource tax policy and micro environmental performance improvement in China's water-intensive industries. Water Resources and Economics, 49, 100258. https://doi.org/10.1016/j.wre.2025.100258
103. Wang, X. Y., & Zhao, H. (2023). Research on the impact of environmental protection tax reform on enterprise green development. Scientific Research Management, 8, 139–151. https://doi.org/10.19571/j.cnki.1000-2995.2023.08.015. [In Chinese]
104. Wang, X., Javaid, M. U., Bano, S., Younas, H., Jan, A., & A. Salameh, A. (2022). Interplay among institutional actors for sustainable economic development—Role of green policies, ecoprenuership, and green technological innovation. Frontiers in Environmental Science, 10, 956824. https://doi.org/10.3389/fenvs.2022.956824
105. Wang, X., Wang, S., Wu, K., Zhai, C., & Li, Y. (2024). Environmental protection tax and enterprises' green technology innovation: Evidence from China. International Review of Economics & Finance, 96, 103617.https://doi.org/10.1016/j.iref.2024.103617
106. Wang, Y., & Yu, L. H. (2023). The impact of environmental regulation tools on enterprise green technology innovation preferences. Management Review, 2, 156–170. https://doi.org/10.14120/j.cnki.cn11-5057/f.2023.02.005. [In Chinese]
107. Wang, Y., Xiao, L., Lv, J., Ji, J., Zhang, M., Li, J., ... & Qian, G. (2024). Carbon tax-driven technological innovation may accelerate the directional recovery of waste cooking oil into bio-jet fuel: An evolutionary game approach. Science of The Total Environment, 931, 172886.https://doi.org/10.1016/j.scitotenv.2024.17288
108. World Bank. (2023). Integration of carbon tax and carbon budgets in South Africa. Retrieved from https://documents.worldbank.org/en/publication/documents-reports/documentdetail/392711506406743392/integration-of-carbon-tax-and-carbon-budgets-in-south-africa
109. World Bank. 2024. State and Trends of Carbon Pricing 2024. © World Bank. http://hdl.handle.net/10986/41544 License: CC BY 3.0 IGO.
110. Wu, X., Li, D. C., & Huang, Q. X. (2024). The impact of environmental protection tax on corporate ESG performance: Green innovation or resource allocation? Business Research, 6, 53–65. https://doi.org/10.13902/j.cnki.syyj.2024.06.006. [In Chinese]
111. Xie, Z., & Zhou, Q. (2025). Guiding innovation towards green: the pivotal role of environmental regulations on innovation direction. RAIRO-Operations Research, 59(1), 683-699.https://doi.org/10.1051/ro/2025005
112. Xu, K. (2024). On the historical evolution and connotation of grey literature. Journal of Southeast University (Philosophy and Social Sciences Edition), (S2), 152–155. https://doi.org/10.13916/j.cnki.issn1671-511x.2024.s2.027. [In Chinese]
113. Xu, L., Peng, S., & Wang, L. (2025). The Synergy of Pollution and Carbon Reduction by Green Fiscal Policy: A Quasi-Natural Experiment Utilizing a Pilot Program from China's Comprehensive Demonstration Cities of Energy Conservation and Emission Reduction Fiscal Policy. Sustainability, 17(2), 667.https://doi.org/10.3390/su17020667
114. Xu, W. (2025). Reform direction and construction path of the green tax system. Institute of Finance and Trade Economics, Chinese Academy of Social Sciences. https://gjs.cssn.cn/kydt/kydt_kycg/202504/t20250421_5870033.shtml [In Chinese]
115. Xu, Y. C., Zhu, X. W., Zhang, Q. H., & Zhang, H. (2025). The impact of differentiated standards of environmental protection tax collection on corporate ESG performance. Taxation Research, 1, 121–131.

https://doi.org/10.19376/j.cnki.cn11-1011/f.2025.01.013. [In Chinese]

116. Xu, Y. K., Huang, J. Q., & Qi, Y. (2024). Environmental protection tax and corporate green investment: From the perspective of incentives and synergy. Study and Practice, 10, 90–100. https://doi.org/10.19624/j.cnki.cn42-1005/c.2024.10.010. [In Chinese]
117. Xu, Y. Z., & Zhou, X. L. (2014). Low-carbon technological innovation under carbon taxation: An empirical study using dynamic panel data. Finance and Economics Science, (09), 131–140. CNKI:SUN:CJKX.0.2014-09-015. [In Chinese]
118. Xu, Y., Wen, S., & Tao, C. Q. (2023). Impact of environmental tax on pollution control: A sustainable development perspective. Economic Analysis and Policy, 79, 89-106.https://doi.org/10.1016/j.eap.2023.06.006
119. Yan, K., Liu, N., Shi, L., Yang, L., & Lu, M. (2025). How does FinTech enable the expansion of green innovation boundaries: Evidence from the interventions of China's environmental protection tax law. Energy Economics, 144, 108367.https://doi.org/10.1016/j.eneco.2025.108367
120. Yang, Q. S., & Li, Y. C. (2024). The impact of green tax incentives on corporate ESG performance. Industrial Technology and Economics, 12, 42–51. https://doi:CNKI:SUN:GHZJ.0.2024-12-005. [In Chinese]
121. Yang, S., Wang, C., Lyu, K., & Li, J. (2023). Environmental protection tax law and total factor productivity of listed firms: promotion or inhibition?. Frontiers in Environmental Science, 11, 1152771.https://doi.org/10.3389/fenvs.2023.1152771
122. Yang, X. M., Pang, Q. N., & Wang, Y. X. (2023). Spatial spillover effect of environmental tax on green innovation: An analysis based on the moderating role of government environmental regulation. China Population, Resources and Environment, 1, 50–60. https:// doi:CNKI:SUN:ZGRZ.0.2023-01-005. [In Chinese]
123. Yang, Y. M., Huang, J. H., & Li, H. L. (2024). The Environmental Protection Tax Law and regional green transition: Mechanisms and effects. Finance and Accounting Monthly, 2, 102–109. https://doi.org/10.19641/j.cnki.42-1290/f.2024.02.015. [In Chinese]
124. Yang, Y., Zheng, T., & Wu, J. (2024). Green taxation, regional green development and innovation: Mechanisms of influence and policy optimization. Humanities and Social Sciences Communications, 11(1), Article 335. https://doi.org/10.1057/s41599-024-03335-4
125. Yao, J. Y., Gong, M. X., Fu, Y., Wei, Q., & Min, D. (2024). Current situation, hotspots, and trends of talent assessment research in China: A CiteSpace visualization analysis based on CSSCI and PKU core journals. Modern Management, 12(3). https://www.hanspub.org/journal/paperinformation?paperid=94791. [In Chinese]
126. Yu, H. Y. (2018). Rethinking environmental protection tax settings: An evolutionary game perspective on green technology strategies of two competing manufacturers. Journal of Finance and Economics Theory and Practice, (04), 94–99. https://doi.org/10.16339/j.cnki.hdxbcjb.2018.04.014. [In Chinese]
127. Yu, L. C., Geng, H. J., & Bi, Q. (2023). The impact of green tax reform on corporate environmental performance. Journal of Management, (06), 916–924. [In Chinese]
128. Yu, L. C., Zhang, W. G., & Bi, Q. (2019). Does environmental tax force enterprises into green innovation? Audit and Economic Research, (02), 79–90. [In Chinese]
129. Yu, L. C., Geng, H. J., & Bi, Q. (2023). The impact of green tax reform on corporate environmental performance. Journal of Management Science, 6, 916–924. [In Chinese]
130. Yu, L. C., Zhang, W. G., & Bi, Q. (2021). Has the reform from environmental fees to taxes promoted green transformation of heavily polluting enterprises? Quasi-natural experimental evidence from the implementation of the Environmental Protection Tax Law. China Population, Resources and Environment, 5, 109–118. https://doi:CNKI:SUN:ZGRZ.0.2021-05-012. [In Chinese]
131. Yu, X., Xu, Y., Zhang, J., & Sun, Y. (2022). The synergy green innovation effect of green innovation subsidies and carbon taxes. Sustainability, 14(6), 3453.https://doi.org/10.3390/su14063453

132. Yuan, L. (2024). Could Environmental Regulations Reduce Energy Consumption: Evidence from China's Implementation of an Environmental Pollution Tax. The Journal of Environment & Development, 33(3), 389-409.https://doi.org/10.1177/10704965241238291
133. Zhang, J., Chen, S. Y., & Wang, K. Q. (2023). The impact of the reform from water resource fees to taxes on green innovation behavior of heavily polluting enterprises. Journal of Hohai University (Philosophy and Social Sciences Edition), 5, 110–124. https:// doi:CNKI:SUN: HHZX.0.2023-05-011. [In Chinese]
134. Zhang, L., Li, H., & Wang, Y. (2023). The Impact of Environmental Tax and R&D Tax Incentives on Green Innovation: Evidence from Chinese Manufacturing Enterprises. Sustainability, 15(9), 7303. https://doi.org/10.3390/su15097303
135. Zhang, X. Y., Li, H. X., Ma, Y., & Tang, Z. J. (2024). Environmental protection tax, government innovation subsidies, and corporate green innovation. Fiscal Research, 2, 98–113. https://doi.org/10.19477/j.cnki.11-1077/f.2024.02.002. [In Chinese]
136. Zhang, X., & Shi, C. (2025). How does Environmental Protection Tax Law affect corporate investment preferences?. Finance Research Letters, 72, 106498.https://doi.org/10.1016/j.frl.2024.106498
137. Zhang, Z., Shi, K., Gao, Y., & Feng, Y. (2025). How does environmental regulation promote green technology innovation in enterprises? A policy simulation approach with an evolutionary game. Journal of Environmental Planning and Management, 68(5), 979-1008.https://doi.org/10.1080/09640568.2023.2276064
138. Zhao, A., Wang, J., Sun, Z., & Guan, H. (2022). Environmental taxes, technology innovation quality and firm performance in China—A test of effects based on the Porter hypothesis. Economic Analysis and Policy, 74, 309-325.https://doi.org/10.1016/j.eap.2022.02.009
139. Zhao, A., Zhang, H., Liu, Y., & Guan, H. (2024). Environmental taxes, technological innovation and firm performance: Evidence from China's manufacturing firms. Heliyon, 10(10). [In Chinese]
140. Zhao, D. C. (2006). Pollution charge-to-tax reform and environmental technology innovation. Social Scientist, (02), 58–60 + 64. CNKI:SUN:SHKJ.0.2006-02-014. [In Chinese]
141. Zhen, M. R., & Jiang, X. Z. (2021). The impact of environmental tax on corporate green technology innovation: The moderating effects of government quality and green procurement. Journal of Dalian University of Technology (Social Sciences Edition), 4, 26–36. https://doi.org/10.19525/j.issn1008-407x.2021.04.004. [In Chinese]
142. Zheng, X. M., & Li, Z. H. (2025). Progress and trends in urban air mobility research. Flight Dynamics, (01), 10–18. https://doi.org/10.13645/j.cnki.f.d.20240313.001. [In Chinese]
143. Zhou, H. W., & Qi, Z. R. (2024). The impact of the Resource Tax Law on green technology innovation in resource-based enterprises. Industrial Technology and Economics, 8, 58–67. https://doi:CNKI:SUN:HHZX.0.2023-05-011. [In Chinese]
144. Zhou, Q., Yabar, H., Mizunoya, T., & Higano, Y. (2016). Exploring the potential of introducing technology innovation and regulations in the energy sector in China: a regional dynamic evaluation model. Journal of Cleaner Production, 112, 1537-1548.https://doi.org/10.1016/j.jclepro.2015.03.070. [In Chinese]
145. Zhou, W. Q., & Nie, M. (2011). Public policy practices and implications for promoting low-carbon technology innovation. China Science and Technology Forum, (07), 18–23. https://doi.org/10.13580/j.cnki.fstc.2011.07.013. [In Chinese]
146. Zhu, W. W. (2023). How does the environmental protection tax affect corporate carbon reduction performance: Internal mechanisms and empirical evidence. Modern Management Science, 4, 127–135. https:// doi:CNKI:SUN:XDGL.0.2023-04-013. [In Chinese]