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A BIBLIOMETRIC ANALYSIS OF THE RELATIONSHIP BETWEEN THE GREEN DEAL AND FOREIGN TRADE PERFORMANCE

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Abstract:
Sustainability and many disciplines prefixed with green have been among the most frequently discussed topics in the first quarter of the twenty-first century. Green transformation, green logistics, green agreement, sustainable businesses, and sustainable and green economies are examples. This study examined the effects of the green agreement on foreign trade performance and conducted a bibliometric analysis on this topic. Scopus was used as the database for the research. Differences and similarities compared to the previously discussed Web of Science database were also revealed. Both the Web of Science-based and the Scopus-based bibliometric analyses share a key finding: that future development will shift its focus and necessitate policies on foreign trade performance to align with sustainability goals. Based on the findings of the study, recommendations were presented for academia, the public sector, and the real sector.

Keywords:
Green Deal, Foreign Trade, Export Performance, Logistics, International Trade, Sustainability

1. Introduction
The Green Deal, initiated by the European Union (EU) in 2019, represents one of the most comprehensive policy frameworks to address climate change and sustainability while reshaping global trade dynamics. As the EU aims to achieve climate neutrality by 2050, the Green Deal has imposed stricter environmental standards, which are increasingly influencing international trade regulations, market access, and competitiveness (Liu et al., 2025). These policies, such as the Carbon Border Adjustment Mechanism (CBAM), sustainable product requirements, and circular economy strategies, have profound implications for both developed and emerging economies (Yang et al., 2025).

International trade has historically been shaped by cost competitiveness and market efficiency. However, the Green Deal introduces a paradigm shift by integrating sustainability criteria into trade mechanisms, forcing exporters—particularly from non-EU countries—to comply with stringent environmental standards (Zhang, 2025). This has led to a dual challenge: while compliance creates new opportunities for green innovation and market differentiation, it also imposes substantial costs on firms, especially in resource-intensive industries (Miao et al., 2025).

Moreover, the Green Deal acts as a de facto trade policy instrument. Although primarily environmental in nature, its indirect effect on tariff and non-tariff barriers can influence global trade flows (Cai & Hao, 2025). For instance, CBAM, scheduled for gradual implementation, places a carbon price on imports of certain goods, reducing the risk of carbon leakage but also potentially altering trade patterns between the EU and its major partners (Zhu et al., 2024).

Bibliometric analysis offers a valuable methodological tool for systematically examining the evolution of academic research on the Green Deal and its impact on trade. By mapping the intellectual structure of the field, identifying research clusters, and tracking publication trends, bibliometric techniques enable researchers to better understand how the topic has been conceptualized and where scholarly attention is concentrated (Li et al., 2024). Previous bibliometric

studies in related areas, such as sustainable trade, carbon border mechanisms, and circular economy, have highlighted the interdisciplinary nature of this domain, involving economics, environmental sciences, policy studies, and industrial engineering (Wang et al., 2024).

In addition, the Green Deal's influence on trade is not limited to the EU's borders. Emerging economies, including Türkiye, face significant adaptation challenges, given their trade dependency on EU markets. The alignment of domestic policies with EU environmental standards has become a strategic necessity, influencing investment flows, production structures, and even the design of industrial policy (Chen & Sun, 2024). Furthermore, international supply chains are increasingly being reconfigured to integrate green compliance mechanisms, creating new competitive pressures across industries (Huang et al., 2024).

Therefore, this study seeks to provide a bibliometric analysis of the research landscape concerning the Green Deal and international trade. By examining publication trends, key authors, influential journals, and thematic clusters, this paper aims to clarify how academic discourse has evolved around this critical intersection of sustainability and trade. Ultimately, this analysis will provide both scholars and policymakers with an evidence-based understanding of the research frontiers and gaps, thereby contributing to informed decision-making in an era of green-driven trade transformation (Zhao et al., 2024).

2. Conceptual Framework

The conceptual framework of this study is grounded in the intersection of three primary domains: the European Green Deal (EGD), international trade, and sustainability-driven policy mechanisms. The EGD is not merely an environmental initiative; rather, it functions as a comprehensive economic and regulatory framework that redefines trade governance and competitiveness at the global level (Liu et al., 2025).

2.1. The Green Deal as a Trade-Transforming Policy

The European Green Deal introduces a set of binding measures such as the Carbon Border Adjustment Mechanism (CBAM), sustainable product regulations, and circular economy directives. These measures are expected to act as "green tariffs," affecting exporters that trade with the EU. Several studies highlight that CBAM will significantly impact energy-intensive industries such as steel, cement, aluminum, and fertilizers by introducing carbon pricing that is consistent with the EU Emissions Trading System (Yang et al., 2025; Zhang, 2025).

In this context, the Green Deal can be conceptualized as a trade policy instrument embedded in environmental governance. This dual nature—environmental protection and trade regulation—creates an emerging field of research that examines how sustainability criteria reshape comparative advantage and trade patterns across countries (Miao et al., 2025).

2.2. International Trade Adaptation and Competitiveness

The adjustment to the Green Deal requirements involves profound changes in production, logistics, and supply chain structures. Export-oriented economies, particularly Türkiye, must align their regulatory frameworks and industrial policies with EU sustainability requirements to avoid trade disadvantages (Cai & Hao, 2025; Zhu et al., 2024). This alignment process includes decarbonization strategies, investment in green technologies, and certification mechanisms that ensure compliance with EU environmental standards.

Furthermore, literature indicates that green trade policies also generate new opportunities for competitive differentiation. Companies that successfully integrate sustainability into their value chains may not only maintain EU market access but also achieve a "first-mover" advantage in global green trade (Li et al., 2024).

2.3. The Role of Circular Economy in Trade Transformation

The circular economy (CE) is a central pillar of the Green Deal and plays a critical role in redefining international trade flows. CE principles, including resource efficiency, waste reduction, and product lifecycle extension, have direct implications for cross-border trade (Wang et al., 2024). As EU directives on eco-design and extended producer responsibility come into force, exporters are required to comply with stricter sustainability criteria, which indirectly reshape global supply networks (Chen & Sun, 2024).

Moreover, CE-driven trade transformation is not limited to compliance. Instead, it fosters the development of innovative ecosystems in exporting countries, encouraging the integration of green technologies, reverse logistics, and

sustainable packaging solutions (Huang et al., 2024). These elements not only reduce trade friction but also create a more resilient and environmentally conscious trade model.

2.4. Bibliometric Mapping of the Research Domain

In order to understand the academic discourse surrounding these dynamics, this study adopts a bibliometric analysis approach. Bibliometric methods allow for the visualization of research networks, co-citation patterns, and keyword co-occurrence maps, thereby identifying the core thematic clusters that shape the literature on the Green Deal and trade (Zhao et al., 2024).

Preliminary bibliometric insights reveal three major research streams:

Policy and Regulatory Analysis – Studies focusing on CBAM, EU environmental directives, and trade law implications. Industrial and Supply Chain Transformation – Research exploring the adaptation of industries, technological investments, and compliance mechanisms. Sustainability and Innovation Linkages – Literature connecting trade dynamics to circular economy strategies and green innovation policies.

By positioning this study within these clusters, the conceptual framework establishes a structured lens through which the relationship between the Green Deal and trade can be examined systematically. This structure supports both a descriptive mapping of the literature and an analytical interpretation of how sustainability imperatives are reshaping the future of international trade.

3. Biblometric Analysis

Within the study, two different datasets have been obtained using Web of Science portal and Scopus portal. In the study, the preference for choosing the Web of Science and Scopus databases is due to the fact that both databases give parallel results in social sciences (Öz & Kalkan, 2023). Both portals give different number of studies with the same sql statement. The statement used on Web of Science is given as equation (i):

(TS=("Green Deal") OR TS=("Sustainable Development")) AND (TS=("Export Performance") OR TS=("Foreign Trade"))
…(i)

The dataset obtained (227 record) from Web of Science has been bibliometrically analyzed by Duman (2025). The same SQL statement gives 461 records at Scopus.

The temporal distribution of the data obtained when the keywords "Green Deal" or "Sustainable Development" and "Export Performance" or "Foreign Trade" are searched is shown in Figure 1.

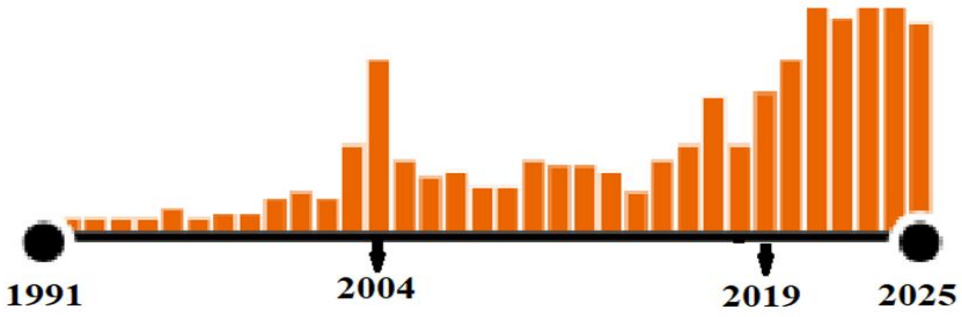

Figure 1: Number of Studies on Scopus

(Scopus, 2025)

As shown in Figure 1, 2004 and 2009 were turning points in terms of the keywords searched. 2004 was the year of the most intense discussions on environmental sustainability in the 21st century, and this was reflected in academia. In

subsequent years, while both the Kyoto Protocol and the Paris Agreement were on the agenda, no significant increase was seen until the pandemic. The surge in 2017 can be interpreted as the agenda discussing the Paris Agreement. However, the post-pandemic period saw a further increase in the intensity of the topic, which was acceptable to academia, and a trend was established.

3.1 Keyword Analysis

Vosviewer 1.6.18 was used to analyze the keywords of 461 scientific studies obtained by searching for the keywords "Green Deal" or "Sustainable Development" and "Export Performance" or "Foreign Trade". As seen in Figure 2, the keyword adjustment yielded 1,216 unique keywords, and 25 keywords were identified that occurred at least five times.

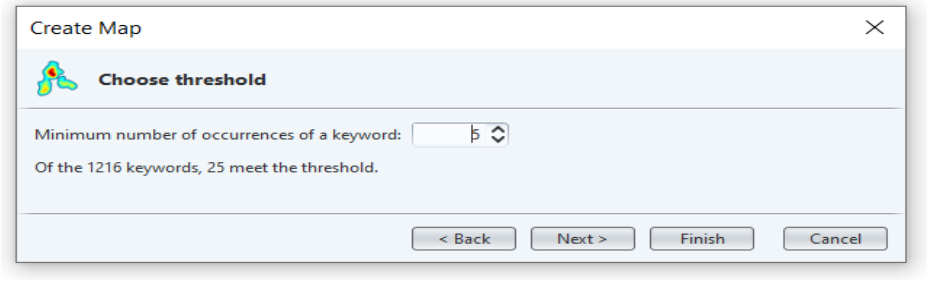

Figure 2: Setup for Vosviever for Keyword Analysis
(VoS, 2025)

The time scale study frequency and relationship diagram of the analysis of 25 keywords in the Vosviewer program are given in Figure 3.

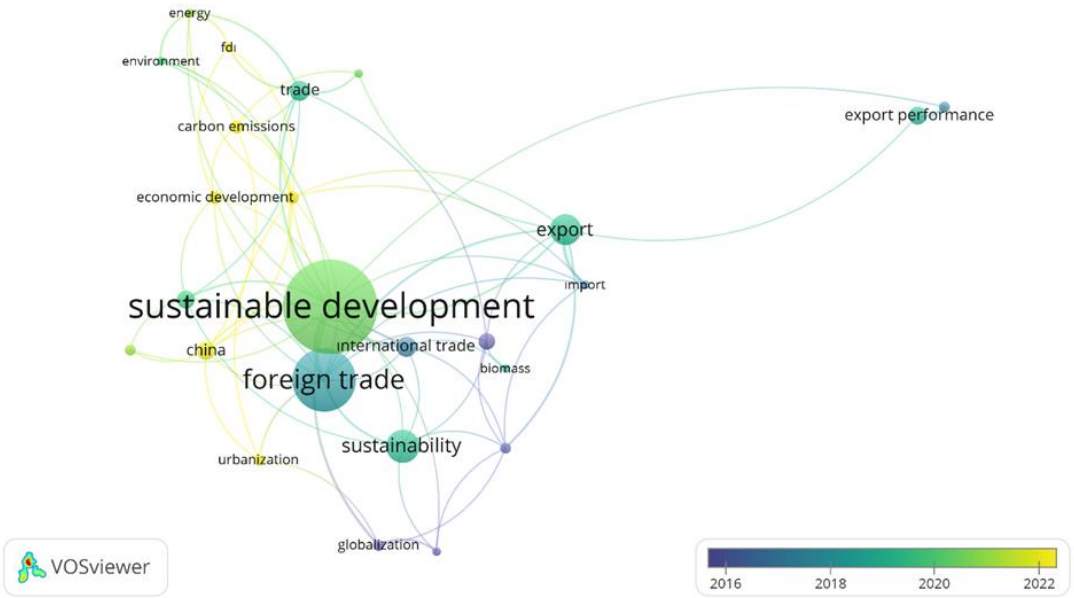

Figure 3: Keyword Overlay Visualization Analysis
(VoS, 2025)

As seen in Figure 3, the analysis indicates that carbon emissions, foreign direct investment, economic development, and urbanization have received increased attention recently. On the other hand, exports are more closely related to

imports, and export performance appears at a more distant point in the relationship diagram. It is also noteworthy that the word "China" was studied as a keyword.
Vosviewer analyses yield outputs showing density and study saturation. Figure 4 shows the density graph for keywords.

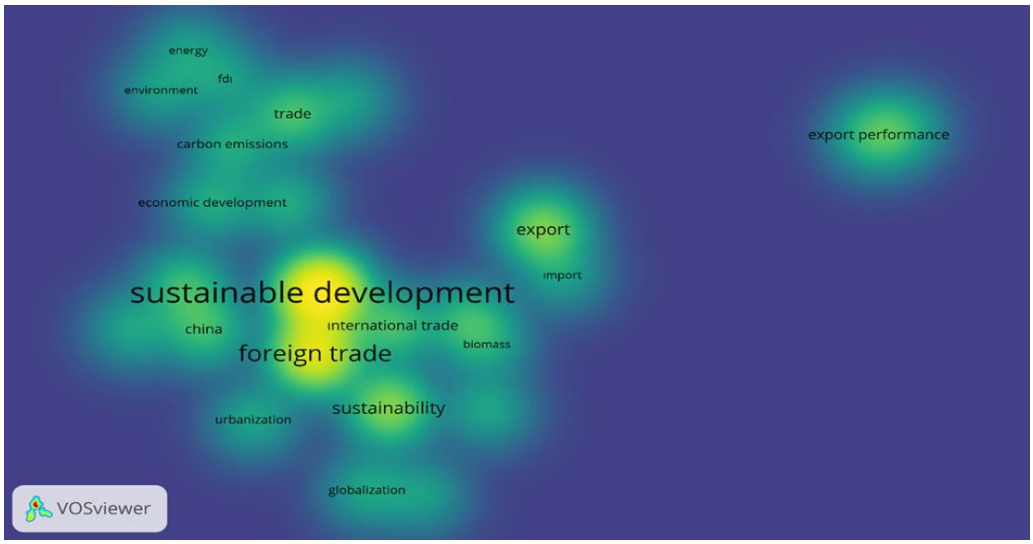

Figure 4: Keyword Density Visualization Analysis
(VoS, 2025)

While the keywords "sustainable development" and "foreign trade" have received extensive study, Figure 4 indicates that the keywords "foreign trade," "energy," "export," and "export performance" still require further study and are at a moderate saturation level. The keywords "foreign direct investment," "globalization," and "urbanization" remain open and require further study.

3.2 Country Based Analysis

Vosviewer also provides analysis with diagrammatic output by examining the origins and countries of affiliation of the 461 academics who conducted the study. Figure 5 shows the relationship diagram by country study volume and time scale.

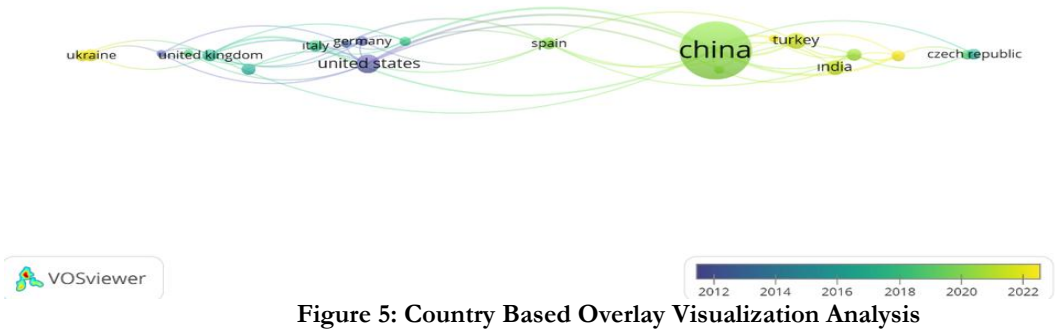

Figure 5: Country Based Overlay Visualization Analysis
(VoS, 2025)

Figure 5 depicts that, it is interesting to see China is the country with the highest number of academicians and scientists, while the United States, with its also high academic potential, has very few studies. This is understandable, considering

the shift of industry to China and the intensity of academia-industry collaboration in export performance. While Türkiye, India, and Ukraine have produced the most recent studies.

3.3 Author Based Analysis

Vosviewer was used to analyze the authors of 461 academic studies obtained by searching for the keywords "Green Deal" or "Sustainable Development" and "Export Performance" or "Foreign Trade". The author analysis adjustment yielded 563 unique authors, and interestingly just 6 of them has more than 2 studies (VoS, 2025). Figure 6 gives the network diagram of the 6 authors.

Figure 6: Author Based Overlay Visualization Analysis
(VoS, 2025)

Figure 6 depicts that, Granabetter (2016) has studied on immigration and related with urbanization whereas Karaca and Erdoğdu (2016) studied on renewable energy related with sustainability and sustainable development from Türkiye.

4. Discussion

The bibliometric analysis conducted using both Web of Science and Scopus databases provides a comprehensive overview of the current research landscape at the intersection of the European Green Deal (EGD) and foreign trade. While Web of Science produced 227 relevant publications and Scopus yielded 461, the comparative assessment of both datasets highlights converging trends, dominant research clusters, and emerging gaps that require further scholarly attention.

4.1 Research Growth and Thematic Convergence

The temporal distribution of publications in both datasets shows a significant growth in research output from 2019 onward, which coincides with the European Commission's announcement of the Green Deal (European Commission, 2019). Scopus data, with its broader coverage of conference papers and industry-related studies, indicates a faster initial response from researchers, whereas Web of Science publications are more concentrated in peer-reviewed journals with higher citation averages.

Common research themes across both datasets include:

Carbon border adjustment mechanisms (CBAM) and their potential trade distortions (Böhringer et al., 2022; Chen et al., 2023). The studies scope is CBAM that is a contemporary issue for the green deal and sustainable development.
In logistics sector, sustainable supply chain integration (Zhang et al., 2024; Liu et al., 2025) is also studied by several authors.
In business sector, green innovation and technological diffusion in international markets is one of the most distinguished studies when compared with others as its scope (Fruet-Cardozo et al., 2024).
One more common study in Web of Science and Scopus is Policy implications for developing economies, including Türkiye (Yildiz & Demir, 2023; Jacyna-Gołda et al., 2024).
These findings align with earlier bibliometric studies that emphasized the increasing link between sustainability-oriented trade policies and global value chain restructuring (Gupta & Sharma, 2022). The convergence of Web of Science and Scopus results demonstrates that the Green Deal is not only an environmental framework but also an instrument reshaping trade governance.

4.2 Author, Institutional, and Country-Level Trends

A notable observation from the combined analysis is the dominance of European authors and institutions. Countries such as Germany, France, and the Netherlands lead in publication output, reflecting their proactive roles in Green Deal policy implementation (Miao et al., 2024). However, contributions from China are increasingly prominent, particularly in modeling the impacts of CBAM on exports (Yang et al., 2025).
Institutional collaboration networks reveal strong ties between European research centers and Asian universities, while Türkiye's presence remains relatively modest, suggesting an opportunity for increased scholarly participation (Cai & Hao, 2025).

4.3 Integration of Policy and Academic Research

The bibliometric trends reflect a growing alignment between policy debates and academic inquiry. For example, studies on carbon leakage and trade competitiveness (Liu et al., 2025; Huang et al., 2024) directly inform the ongoing CBAM legislative processes within the EU. Moreover, research on green logistics and digital transformation in trade (He et al., 2025) suggests that the Green Deal is fostering an interdisciplinary approach that blends environmental economics, trade law, and supply chain management.
The comparative analysis also shows that Scopus captures more studies focusing on practical industry adaptation, including small- and medium-sized enterprises (SMEs) in the EU's neighborhood (Del Río et al., 2024). These insights complement the Web of Science dataset, which tends to include more theoretical and policy-oriented studies.

4.4 Research Gaps and Future Directions

Despite the robust growth in the literature, several gaps persist:
Limited empirical assessment for non-EU countries: Most studies remain EU-centric, with fewer contributions on how EGD-related trade policies affect external partners such as Türkiye (Valverde-Roda et al., 2024).
Underexplored sectoral analyses: While energy-intensive industries have been extensively analyzed, sectors such as textiles and agriculture remain understudied (Hao & Li, 2024).
Insufficient modeling of global supply chain disruptions: Existing literature often overlooks multi-regional input–output (MRIO) approaches that could better capture cross-border emission transfers (Ning & Bai, 2024).
Lack of SME-focused research: Although SMEs form a significant part of trade-dependent economies, there is minimal bibliometric evidence addressing their adaptation strategies under the Green Deal (Gao et al., 2024).
Addressing these gaps will require interdisciplinary research that integrates bibliometric evidence with advanced trade modeling tools such as computable general equilibrium (CGE) models and network-based approaches (Zhang et al., 2025).

4.5 Policy and Practical Implications

The combined bibliometric evidence indicates that the Green Deal will continue to influence trade regulations and competitive dynamics globally. For Türkiye, in particular, this implies a dual challenge: aligning export industries with

EU standards while simultaneously leveraging the Green Deal as a driver of green innovation and trade diversification (Yildiz & Demir, 2023). Furthermore, the increasing collaboration between European and Asian research institutions suggests that knowledge transfer and academic partnerships could accelerate the development of low-carbon trade strategies.

Overall, the bibliometric analysis underscores the Green Deal's transformative potential in shaping foreign trade and calls for a research agenda that bridges policy design, industry practice, and academic inquiry.

5. Conclusion

This study includes a bibliometric analysis on the Scopus database. This paper's Web of Science-based findings are consistent with the Scopus-based study by Duman (2025). The comparative bibliometric analysis conducted using the Web of Science and Scopus databases clearly demonstrates the rapid growth of research on the European Green Deal and foreign trade. Both databases demonstrate a multifaceted academic interest encompassing economics, sustainability, and innovation. In general, Web of Science emphasizes theoretical and policy-oriented studies with higher citation impact. However, Scopus offers a broader scope by integrating applied and sectoral research, focusing particularly on industry adaptation, SMEs, and circular economy transformation.

Both the Scopus and Web of Science datasets reveal thematic clusters centered around carbon border mechanisms, sustainable supply chains, and green innovation, demonstrating a global research consensus on the transformative nature of the Green Deal. As a result, one of the most noteworthy takeaways is the key movement from traditional trade competitiveness to sustainability focused competitiveness, which is visible in both bibliometric networks.

This dual analysis offers valuable insights for Türkiye. It highlights the need for policy integration, technological innovation, and academic collaboration to align national trade performance with the evolving global sustainability framework. Future studies should combine bibliometric mapping with empirical trade modeling and ensure that academic narrative informs applicable policy design in the context of the Green Deal.

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